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THE PRACTICAL TEACHER

WELL-KNOWN TEACHERS AT WORK: MRS. R. A. CASHMORE.

EMPIRE SUPPLEMENT PRESENTED WITH THIS NUMBER

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THE CONGRÈS INTERNATIONAL DES LANGUES VIVANTES.

BY OUR SPECIAL CORRESPONDENT, MONS. P. MIEILLE OF TARBES.

NO task could have been more pleasant, and—if I may say so—more congenial to me, both as a personal friend of the practical teacher and as a teacher of modern languages, than that of gathering for the readers of this journal a few interesting items of information respecting the **Modern Language Teachers' International Conference at Paris.**

The Congrès International des Langues Vivantes is one of the two hundred meetings of a similar kind to be held during the months of August and September at the Paris Exhibition. It is the first International Conference of Modern Language Teachers, and as such it may be looked upon as the beginning of a new era for this branch of the teaching profession.

As every practical teacher knows, it is not very long since the French master in England, the English master in France, etc., were held to be on a par with the other members of the teaching profession ; and if I am not mistaken, it was with a blended smile of amusement and contempt that the graduates of every university in the world greeted the pretensions of modern language teachers to any kind of pedagogical competence and training. How prejudicial to the study of modern languages this condition of things was need not be insisted upon here. We are all aware of the backward state—a shame for civilised countries—of the teaching of modern languages in both countries ; and both in England and in France we are awaking to the fact that something must be done to give our schoolboys and schoolgirls a practical acquaintance with living languages.

Our *Congrès* was the best means that could have been devised for bringing home to every practical teacher the importance and fast-increasing necessity of our branch of the profession. I was at once greatly impressed with the earnestness of the delegates and the business-like way in which they set about the work before them. "These men," I thought, "have nothing dreamy or unreal about them ; they mean business." And they did. Another favourable impression was caused by the warm feeling of brotherhood that pervaded our gatherings, and gave to our sittings, instead of a Babel-like confusion of tongues, the home-like touch of a family circle.

It was interesting to note the great number of German teachers present compared with those of other nationalities.

It is neither the time nor the place, or I should like to ask the wiseacres who will sneer and rail at the so-called Utopists that advocate international concord, how it is possible that men—English, French, Germans, Austrians, etc.—may live together during five days, discuss together, express different opinions, now agree, now differ, and never lose the intimate sense of the brotherhood of men, and never feel the existence of the pretended barriers that, if we are to believe the doctors of Boxerism, separate the different peoples ? Is it because those present at our Congress are teachers ?

My intention is not to give a detailed account of the Conference. I shall confine myself to a few facts—I had better say a few features—such as may give a clear idea of the *Congrès* to those readers of The Practical Teacher who had not the good fortune to be present.

The internationalism of contemporary life was marvellously set forth by the exterior side of the gathering. From Russia to Mexico, from Italy to Denmark, including the Balkan States and Hungary, every civilised nation had sent its delegates ; and if I may be allowed to make a remark, many of those foreign delegates spoke French fluently. Two of them, Mr. Belger, lecturer at the Durham College of Science, and Mr. Herbert Strong, the Scotch delegate, seemed "to the manner born," and spoke French most "fetishly" —not Stratford-atte-Bow French, but quite the right Parisian sort.

THE BRITISH SOUTH AFRICAN COLONIES
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Inspector-General Bosserz, who pronounced the opening speech, rightly insisted upon the international importance of the gathering. He said:—"Je viens tout d'abord, au nom du comité d'organisation de ce congrès, souhaiter la bienvenue à tous ceux, Français ou étrangers, surtout étrangers, qui ont bien voulu répondre à notre appel. Je dis surtout étrangers, car ce congrès est doublement international: il l'est par la communauté de ses travaux, et il l'est par son but, qui est de rapprocher, d'unir par un lien plus étroit toutes les nations civilisées. Rapprocher, unir, tel est le but. Et quel est le moyen? Il n'y en a qu'un: de mieux connaître."

And these were his concluding words, enthusiastically applauded by all present:—"Les étrangers verront ce que nous avons fait en France, ils nous diront ce qui s'est fait à l'étranger; ou plutôt, il n'y aura plus ici d'étrangers; il n'y aura que des éducateurs chargés de préparer pour le siècle qui commence et pour toutes les nations civilisées une jeunesse vaillante, pacifique, instruite et laborieuse."

The programme of the *Congrès* was rather too encyclopedic, as M. Michel Bréal, the eminent Membre de l'Institut, finely remarked. Every question related to the teaching of modern languages was to be canvassed and voted upon. The division of the Congress into three sections was another mistake. As was pointed out by Herr Hartmann, the distinguished Leipzig professor, division of work is all right when you have to deal with questions of different order; but in the present case all the questions of the programme were so closely connected, that there was the danger of frittering away the interest and the time of the members by obliging them to run from one section to another, and dispersing their attention instead of concentrating it. For instance, the first section took Methodology; the second, the industrial and commercial side of the question; the third had to deal with the international bearings of modern language teaching. The three sections sat at the same time, so that a member interested in the work of the three sections, as were most of our number, had to sacrifice one or two of the subjects treated.

However, "where there's a will, there's a way," and it is but just to say that the three sections worked earnestly, and got through a very satisfactory amount of work.

Forty papers had been sent, half this number by foreigners, and there was plenty of food for discussion. Each section discussed its own topics, voted upon them, and the resolutions thus voted came again before the general assembly that had to decide finally on their adoption or rejection. This is a summary of the results arrived at.

As to Methodology, there was unanimity in the first section in pronouncing for the *méthode directe* or intuitive method, such as is set forth in Nelson's French and German Object Lesson Sheets, and Schweitzer's Wall Pictures.

The teaching of grammar was restricted to a few practical rules—the example preceding instead of following the rule; translations of foreign authors to be very sparely used; and translation from the mother-tongue into the foreign language to be absolutely abandoned as a means of teaching modern languages.

The delegates were unanimous in proclaiming the necessity of every-day English, French, and German becoming the basis of our teaching, and the need of a common ground and common doctrine on which and in which all the teachers of modern languages may meet in the interests of their profession. Modern language teaching, being an outgrowth of international needs, may well profit by an international pedagogy, and be given on international principles.

As Mr. Belger remarked to me, it is really wonderful to think that so many men, met from so many different countries, brought up under such different kinds of tuition, should agree so completely in their views. To put it in the very words of Mr. Belger: "As to the methods of commercial correspondence, Dr. Knauser of Vienna, Inspector Regreiz of Paris, and myself found to our great surprise that we had treated the subject in exactly the same way."

The commercial section arrived at the following conclusions:—(1) That modern language studies must first be general, then special, the usual language to be acquired before the technical; (2) that these studies are generally spread over too many years. Mr. Belger stated that he had succeeded in giving several young foreigners, French and German, an acquaintance (sufficient for business) with English, by means of four short lessons every day for three months; (3) that the method for teaching languages cannot be the same with adults as with children; and (4) that commercial teachers must complete their technical knowledge by an acquaintance with technical words and expressions acquired at a special course of practical lectures given in every commercial centre by competent men of the trade or profession.

The third section had to deal with scholarships, international correspondence, exchange of schoolboys and schoolgirls, the necessity and the possibility of an international language, and last, not least, the founding of an International Union of Modern Language Teachers.

The programme was very interesting, and such as to deserve the earnest attention of teachers. Unhappily, owing to that unlucky division into three sections, our sittings—I belonged to the third section as a Member of the Committee—were not attended as they might otherwise have been. Nevertheless, we did excellent work, and were able to submit to the general meeting that closed the *Congrès* a series of resolutions or *vœux* that were carried unanimously, with the single exception of that relating to the universal language, which was defeated by an enormous majority, or rather slurred over as not deserving the attention of the assembly. This was rather to be regretted: for, after all, who knows but the times are near when the need for one universal means of communication may be stronger than all the prejudices and arguments of a dozen Congresses? Bolack's "Blue Language"—*Langue Bleue*—and Dr. Zamenhoff's Speranto are by no means despicable. Captain Gastoy Moch nearly convinced us of the third section that the "Espéranto" was the solution.

The readers of this journal know all about International Correspondence, and I need not enlarge upon the subject here. The third section was keenly interested in the special report I had the honour to read before the members, and the *Inter-Teacher*, so aptly christened by our editor, Mr. Scheurmier, got its own share of recognition. The two thousand French and English elementary masters who have corresponded through THE PRACTICAL TEACHER and LE VOLUME, the four thousand of every nationality put in correspondence through the agency of the *Manuel Général*, the four thousand adults, the seventeen thousand five hundred schoolboys and schoolgirls, paired in the *Revue Universitaire* of MM. Armand Colin, through the agency of *The Review of Reviews* for England, of Professor Hartmann of Leipzig for Germany, of Professor Magill of Swarthmore College for the United States, were *facts* that spoke for themselves. The section unanimously carried a resolution to this effect: "That the exchange of boys between families of different nations was not only an excellent means of perfecting the study of a language, but further to bring about a better understanding between peoples; and that International Correspondence, for its technical usefulness, together with its social and international possibilities, for its rich capabilities of general culture, and its influence over the development of the youthful minds, was to be strongly recommended to every teacher, in elementary as well as in secondary schools."

Professor Hartmann made, in excellent French, a very interesting speech on the question, and insisted upon a wise supervision of the teachers being a condition of success. He said that too many masters kept back for want of a sufficient acquaintance with the good results of International Correspondence. He maintained that the knowledge of the parent's profession was a necessary element of information for the successful working of the scheme; and concluded by some very interesting personal experiences of the way in which the rules of the Leipzig Correspondence Bureau are dealt with and worked.

Director Rémény of Budapest, the well-known educationist and writer, the president of the third section, followed with a congratulatory speech, and moved the resolution to be submitted to the general assembly. As said above, this resolution was unanimously carried.

The work of the third section concluded with the dis-

BRITISH MUSEUM

cussion of Director Rémény's scheme of an International Union of Modern Language Teachers, and a resolution to that effect was adopted. The periodicity of international conferences for modern language teachers was also voted, and a resolution tending to the nomination of an international committee of organisation was also carried by the general vote of the congressists.

In short, this first International Conference of our brethren of the modern language teaching community was a decided success. It would appear that an immense step has been made in the simple recognition of the claims of our branch of the profession to a more generally recognised influence in modern education. As President Bosserz expressed it, in modern language teaching there are no foreigners; all the members felt united by the kinship of a like love for children, and the differences of nationality were merged, so to speak, into the deep intellectual feeling of brotherhood that was the outcome of every word said and spoken.

A decision of the Congress that came up for discussion only at the last general assembly, I must not forget to mention, as it will not fail to interest the majority of the readers of THE PRACTICAL TEACHER. The following resolution was voted:—

"That it is desirable that modern languages should be introduced, as a rule, not as an exception, into the curriculum of elementary schools—*écoles primaires élémentaires*—at least in the higher classes—that is, the "*cours complémentaires.*"

As regards France, the carrying out of this measure would be very conducive to uniformity in the classes in *enseignement moderne*, and benefit also to the recruiting of commercial and industrial schools, in which the knowledge, at least elementary, of a living language is required.

I must not conclude these short notes without reference to a kind of informal meeting on behalf of International Correspondence that took place at the end of the week. At the request of Mr. W. T. Stead, whose untiring energy and zeal for educational matters in general and International Correspondence in particular cannot be too warmly commended, several distinguished professors and teachers of modern languages assembled to discuss the means of furthering and developing the scheme already so familiar to the readers of this paper. Among the numerous English and foreign teachers who were present at this meeting, I had the pleasure of meeting there Professor Geddes of Glasgow University, Professor Buisson of the Sorbonne, Professor Reynier, the representative of Messrs. Colin the publishers, the editor of the *Revue des Revues*, Miss Lawrence of *The Review of Reviews*, Miss Scott, Miss de Puats, etc.

As all were agreed as to the usefulness and practical results of the International Correspondence, there was no jarring voice in the discussion, and the final decision was come to that it would not do to let the public interest in the International Correspondence flag, and that steps should be taken in all countries concerned to wake up the parents, masters, and pupils, and reach the many who had not, so far, responded to our appeal.

But as I mean to give our readers in the October number of this journal some further information about the International "Congrès" that are taking place every week in Paris, I shall leave for my next article what I may have to add on the subject.

The International Correspondence will come up for discussion at the Congrès International de l'Enseignement secondaire. The conference of elementary teachers will also offer many points of interest to practical teachers, and I shall try to bring it home to them.

* * * * * *

So as in France *tout finit par des chansons*, our Conference was closed by a banquet and a *soirée de gala* at the Opera, where flocked representatives of the teaching world of every country. Never before in my life have I seen such a pedagogical audience; and I am sure that the souvenir of that *soirée*, together with the unfailing *courtoisie* shown to all our foreign "friends and brothers," will remain one of the best-remembered attractions of the 1900 Exhibition.

And may the organisation of the next International Conference be as successful, and may it take place in London.

WITH OUR CHILDREN.

BY J. GUNN, M.A., D.SC.,
Author of "Class Teaching and Management," etc.

Another Enquête.

THE "schedule of questions" still survives the attacks of its enemies and the indiscretions of its friends. The howler-hunter has recently found his peculiar quarry in a paper contributed to *The Nineteenth Century*, by Mrs. S. A. Barnett, on "Town Children in the Country." The idea was suggested by Mrs. Franklin, of the P.N.E.U., to propose a series of ten questions to children who had returned from the fortnight's holiday in the country provided for a number of pupils from schools in London. The whole number of children who enjoyed this holiday was 32,000, from 470 London schools. Of these, 52 schools volunteered to submit to the *enquête*, and to those schools 1,161 papers were sent. Only 27 schools returned the schedules, answered by 330 children, ranging from Standard III. upwards.

The writer did not feel discouraged at this result. This is noteworthy: discouragement would have been quite excusable in view of the fact that only one per cent. of the children and five per cent. of the schools took an active part in the scheme. It is also noteworthy that half of the schools which applied for and received schedules returned these filled up. Yet when one reads the questions which are given as samples one cannot feel surprised at such a result.

In the preliminary letter sent to teachers whose pupils were about to share in the country holiday, the writer says: "We were careful to explain that 'our hope is not so much that the children should learn certain facts about Nature so that they can pass an examination, but that they should learn to observe.'" We do not quote this so much on account of its breach of the conventions of English composition, as on account of the view which it seems to imply regarding observation—a view which is further exemplified in the character of the questions set. Observation, it would seem, is regarded as a faculty, just as memory used to be in our psychology and phrenology. If a boy or a girl cannot tell whether sheep rise "with their front or their hind legs first" (whatever that may mean), or what rabbits drink, or how many times crows fold their wings after alighting, want of observation is assumed to be the reason for the lack of knowledge. Observation, again, is to be drawn upon for an answer to the question, "What makes the moon give light?" Regarding this last question, we are told, "Some of the people to whom I submitted our questions for helpful criticism objected." And one cannot help wondering why only *some* of them did so.

Observation of things in general—the observation of the person who merely keeps his eyes open, or probably his eyes and his mouth as well—has no educative value, and is incompatible with useful mental exercise. Real observation implies attention, and attention is always, voluntarily or involuntarily, accompanied by concentration, and restriction of the field of observation. Eye and mind should not form a photographic camera whose sensitive plate gathers up passively scattered images for future development and use. The test of useful observing is not the number of unconsidered trifles which have drawn the wandering gaze. Yet the whole tendency of the questions set is to encourage such a star-gazing habit. They embody the principle of the selection of the insignificant. One is reminded of an old test of this pseudo-observation—asking a student how many buttons were on his waistcoat, or how many steps in the front stairs, and deciding from the correctness of his answers the power of his "faculty of observation." Teachers who have even the slightest acquaintance with the laws of the development of knowledge and the phenomena of apperception will not wonder at the small percentage of answers returned to the schedules in question.

The most noteworthy circumstance connected with this new *enquête*—an eminently satisfactory circumstance from some points of view—is that it has received the cordial approval of one of our leading educational papers which has hitherto consistently condemned all such experiments with

children. We hail with pleasure this welcome change of attitude. We only wish the occasion of it had been more worthy of approval. That children should be led to think about what they see is wholly good. To assume that they really *see* all that is within their field of vision is an obvious error. To select the most insignificant and unrelated objects as the things which they ought to have noticed is wholly bad. By all means let us try to guide and to encourage observation; but let us also try to know in the first place what observation is, and what it implies.

A word as to what use should be made of such schedules when filled up might not be out of place. We cannot believe—and this opinion we have already expressed in these columns—that the best use to make of them is to cull a few pages of amusing blunders and present them to the general public in a popular magazine. There are surely some indications of general tendencies which may be gathered from the answers even to such questions as those under discussion. Yet the only useful principles presented in the article are those quoted from the Board of Education's official publications. One is forced to the conclusions—(*a*) that the choice of quotations from the answers received exemplifies the same mental habit which is apparent in the construction of the question schedules—the selection of the non-significant and unrelated; (*b*) that if any serious or useful aim was in view, it has been most successfully concealed throughout the greater part of the paper; and (*c*) that the excellent ideas expressed towards the close have little or no relation to the inquiry which forms the occasion of the article.

The "Royal Road" at last.

Many generations of weary dominies have sought it in vain, or found it only in their day-dreams. So consistently have they missed it that, when at last one said in his haste, "There is no Royal Road," his despairing cry was accepted as truth by his compeers, and has been echoed down the ages as an educational axiom. This venerable error has now been definitely exposed: the Royal Road has been discovered, and in part surveyed and opened for traffic.

This remarkable discovery is announced in a paper which appears in *Harper's Magazine* for July, on the "Educational Use of Hypnotism," by John D. Quackenbos. Teachers in the past have aimed at keeping their pupils as wide awake as possible, and securing the maximum of voluntary effort as a means to education. Thus they have missed the highway in question. It lies in the sphere of hypnotic suggestion, through which alone mind and morals may be elevated and perfected, free from the trammels of all physical limitations.

We have no doubt that every teacher will read and ponder the article for himself, but we cannot refrain from quoting a few sentences. "His (the subject's) memory becomes preternaturally impressible. The principles of science, of language, of music, of art, are quickly appropriated and permanently retained for post-hypnotic expression." ".....The educating mind of the school-child may tread that Royal Road to learning which ancient philosophers sought for in vain." "The lesson of hypnotism here is a lesson of man's susceptibility to limitless progression.....The state of hypnosis seems to prove that we have within us an immaterial principle entirely independent of sense organs and sense acquisitions."

There is only one hint of a limit in the operation, and that is the qualifications of the hypnotiser. "To accomplish his part in the work of intellectual uplift, the hypnotiser must be a person of liberal education, broad views, and pronounced literary and scientific convictions. He must be a sincere believer in his own suggestions." Of course the reader will easily see that the supply of such operators is practically unlimited, for one such operator—the writer of the article, for example—can easily transform many others into such a pattern, however much they may be lacking by nature. "Tact, patience, and erudition are the three factors indispensable to success;" but, then, these are just the things which can be bestowed by hypnotic suggestion in the repairs-executed-while-you-wait fashion. It is no longer necessary to regard these qualities as implying any special advantages of education or natural endowment.

In saying so, we are by no means exaggerating the claims of the writer, whose experiments in "creative communication embrace cases of backward and erratic children, disequilibration, voice culture, the development of musical talent, and the inspiration of writers and actresses." (Why not actors, we wonder?)

The prospect opened up by this last sentence is so brilliant that we cannot really keep our eye fixed on the children, with whom our chief concern naturally lies. Think for a moment of the inspiration of our writers! Formerly one inspired genius in a century or two was a matter for congratulation; now, inspiration will come with less labour than we have been spending on, say, the teaching of spelling or of the multiplication table. Voice culture, too! Not alone in the expensive seats of the concert hall, but upon the pavements of our common streets, we shall hear and delight in voices hypnotically trained to a limitless perfection. Yea, more; proficiency in piano-playing on the part of those who understand the technic is assured in a comparatively short time by suggestive instruction of this nature," and, of course, if the technic is *not* understood, it will be an easy matter to impart it by the Royal Road.

Modern educators are inclined to smile at the French theorist who held that one could teach what he himself did not know. Yet it turns out that he was right after all. For we read, ".....such results can be reached by a person who is himself without musical ability,"—and, in passing, we wonder why he remains without such ability when it is so easy to acquire all sorts of ability by hypnotism. It seems almost criminal to remain a day longer without it; for this is, after all, a small thing to demand from a process which can record among its triumphs "a congenital cerebral deficiency overcome."

Teachers whose voice gives them trouble will be glad to learn that singers "have had recourse to hypnotic treatment for.....sensitiveness to changes in the weather," and that after such treatment, one lady, who was troubled with hoarseness and thickening of the vocal cords, "rendered the *Stabat Mater* to her complete satisfaction," and presumably to the satisfaction of her audience, though this is not stated.

Some readers may be less surprised to learn that in the case of an actress, "the quickening of her faith in her own powers of impersonation, the elimination of all admission of inferiority even to the stars of her profession, the emphasizing of her native dignity and grace, the pushing of her individuality into bold relief, is an easy feat to a suggestionist of strong personality," and they may even hazard the opinion that the reverse process seems, on the whole, to present greater difficulty.

With one statement in the closing paragraph of the article every reader must feel himself in cordial agreement: "The latest triumphs of suggestion must refute many theories of pedagogy that are taught in the colleges." They do; and they refute a good many other theories not confined to the colleges. Its triumphs, assuming this account of them to be worthy of acceptance, and scientifically verified, are simply "pro-dee-jus."

Yet it will not be enough to rest in the state of belief or of incredulity in which the perusal of this article may leave us. "Suggestion" is a real power, and its educative value is largely an unknown quantity as yet. It is, moreover, a dangerous tool to play with; much quackery has brought it into disrepute, and serious investigators are few. Surely our experimental psychologists should give us some safe and scientific lead on such a matter.

For the Coming Winter.

The various branches of the British Child-Study Association are now making preparations for their winter campaigns, and the programmes of two of these are before us as we write. We should be glad to receive from time to time information regarding the work of all branch associations, which might be sent addressed to the care of the editor of this journal. Much of the work done is deserving of the widest publicity, in order to be helpful and stimulating to all workers in this field.

The London Branch announces an attractive lecture programme, including such subjects as, "The Child as Director of the Parent's Education," "The Elementary Schoolgirl's

Notions on Social Economy," "The Practical Effect of Recent Child-Study on Education," "Children's Ideas on War," and "Children's Social Ideas." This branch has also been very successful in carrying on practical work in local circles. We should strongly advise teachers who do not already know all about children to put themselves in communication with the honorary secretary, Miss Kate Stevens, Carlisle House, Dartmouth Park Hill, N.W. If they do not make any original discoveries in child-study, they will at least be likely to learn something to their advantage.

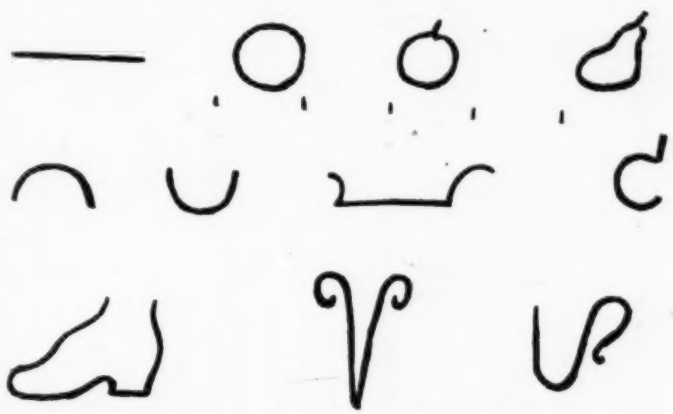
The Edinburgh Branch are to follow out the plan which proved so successful last year, and group their lectures, and possibly their experiments, round one centre of study. Last year "Memory" was the centre: this year "Rest" is to form the subject of discussion and investigation. "The Natural History of Rest," "The Physiology of Rest," "Mental Rest," "Rest and Recreation from the Schoolmaster's Point of View," and practical experiments, such as may be carried on in school, form some of the items of a very suggestive programme. In addition, a series of four lectures and demonstrations on "Nerve Training," by Mrs. William Archer, a specialist in this subject, are being arranged for as a special course. Applications for the special tickets required for this course should be made to the honorary secretary of the branch, Miss L. M. Hardy, St. George's High School for Girls, 5 Melville Street, Edinburgh, to whom also inquiries regarding the ordinary affairs of the society should be addressed. Many of the foremost physiologists and specialists in the treatment of children take part in the work of this branch; and this, in a world-renowned medical centre, gives a unique value to the session's work, especially to teachers.

WELL-KNOWN TEACHERS AT WORK.

MRS. R. A. CASHMORE,

HEAD-MISTRESS, INFANTS' DEPARTMENT, GOODRICH ROAD BOARD SCHOOL, LONDON.

CHARGED by the editor of this magazine with the very pleasant mission of visiting the Goodrich Road Infants' Board School, for the purpose of studying some of the methods adopted by the head-mistress and her staff, and reporting thereon, I gaily went awheel through the South London suburban delights of Herne Hill, passing the well-known "Half Moon" and the "Greyhound" (now converted into handsome modern hotels), Dulwich village with its picture gallery and celebrated college, through the handsomely laid-out Dulwich Park to Barry Road, where I quickly found my way to the object of my journey, for there were scores of merry little feet and voices concentrating in one direction.



FORMS MADE BY HALF-YARD OF CORD IN BABIES' ROOM.

It was evident at once to me that the owners of the aforesaid feet and voices had determined to use their powers of observation to the fullest; for on ringing my bell for a small clearance, there were quiet remarks made concerning me and my belongings, my wearing apparel, and my machine. One small chap noted that the panel of the gear-case was transparent, and asserted that it was made of glass; another stated the reason for its transparency; whilst yet another made a slight touch upon it, to discover that it was not glass but something like it.

PIN AND BEAD.

BRUSH-DRAWING FROM NATURE.

The reason of this seeking after knowledge, and the cultivated powers of observation, were very soon apparent to me after being half an hour inside the building; and I trust the readers of THE PRACTICAL TEACHER will as readily acknowledge it. The infants' building is situated on the ground-

INFANT DEPARTMENT TIME-TABLE.

	Class.	9 to 9.20	9.20 to 9.40	9.40 to 10	10 to 10.30	10.30 to 10.45	10.45 to 11.20	11.20 to 11.55	11.55 to 12	2 to 2.25	2.25 to 3	3 to 3.15	3.15 to 3.50	3.50 to 4.20	4.20 to 4.30
MONDAY.	I. II. III. IV. V. VI.	PRAYERS AND EARLY MARKING.	Hymns and Texts.	REGISTERS CLOSED, AND DRILL.	WORD-BUILDING OR READING.	RECREATION.	NUMBER LESSONS. COUNTING OR ARITHMETIC.	WRITING. FREE-ARM DRAWING OR SINGING.	DISMISSAL.	MARKING REGISTERS, AND REPETITION.	Object Lesson. ,, ,, ,, ,, ,,	RECREATION.	Singing or Repetition, or Drawing, or Kindergarten Occupation, and Games and Story Telling.		DISMISSAL.
TUESDAY.	I. II. III. IV. V. VI.		Old Testament.								Geography. ,, Sense Training. ,, ,, ,,				
WEDNESDAY.	I. II. III. IV. V. VI.		New Testament.								Object Lesson. ,, ,, ,, ,, ,,				
THURSDAY.	I. II. III. IV. V. VI.		Old Testament.								Geography. ,, Object Lesson. ,, ,, ,,				
FRIDAY.	I. II. III. IV. V. VI.		Texts and Hymns.								Writing. Drawing. ,, ,, ,, ,,				

Girls only take two hours for Needlework from Arithmetic and Writing below Standard I., and one hour from Arithmetic and Writing and one hour from Kindergarten in Standard I.

This satisfies Act requirements. C. D. Du Port, H.M.I.—*May 11, 1894.*

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floor, and is separate and distinct from the other departments. The hall from which an entrance is gained into the class-rooms is at once interesting to child-student and visitor, to both old and young. It presents us with the delights of a small picture gallery of most interesting subjects. There are pictures of the great creatures of the Zoological Gardens, engravings of fine pictures such as Sir Lawrence Alma Tadema's "Spring," and coloured lithographed copies of such work as the late Henry Moore's seascapes; whilst Miss Horne, a thorough artist and teacher, has brought her oil-paints into requisition, and drawn upon the glass panels of the class-room doors. The floral decorations and cool-looking shady groups of ferns made the appearance of the hall an ideal place for summer. I was most cordially received by the quiet dominating spirit of the department, Mrs. Cashmore, who at once offered to show me some of the inner workings of her school. She was seen with some of her staff superintending the unpacking of wild flowers which had just come to hand, and which were about to be used by the children in the afternoon lessons, so that my surroundings seemed at once a veritable kindergarten in a double sense. The flowers for the school are not only brought by the children, who are both encouraged and delighted to do so, but boxes are sent down during the season through the agency of the London Flowers Mission Fund and other efforts. The children from Mrs. Amphlett's Girls' High School, St. John's House, Oxford, and those attending the Girls' High School, Hayward's Heath, under the superintendence of Miss M. Sharpe, gather the flowers in

"DRAW WHAT YOU LIKE."

BABIES' ROOM TIME-TABLE.

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MONDAY.	PRAYERS AND EARLY MARKS. FREE DRAWING.	Texts and Hymns.	PHYSICAL EXERCISES.	REGISTERS CLOSED. FREE DRAWING.	FREE-ARM DRAWING. OBJECTS AND FREE PLAY DRAWING.	RECREATION OR FREE PLAY.	GAMES, SINGING OR RECITATION.	Sticks and Rings (Design).	GAMES, SINGING OR RECITATION.	Number (Concrete).	DRESSING AND DISMISSAL.	MARKING REGISTERS. FREE DRAWING AND PHYSICAL EXERCISES.	Object Lesson.	RECREATION OR FREE PLAY.	Paper Folding.	SINGING RECITATION, STORY, OR GAME.	Game or Story.	
TUESDAY.		Old Testament.						Sorting Threads or Seeds for Number, Colour, etc. Straight and Curved line Objects formed.		Number (Concrete).			Sense Training.		Thread Laying Objects in connection with Story or Lesson.		Paper Laying of Straight-line Objects and Designs.	
WEDNESDAY.		New Testament.						Sense Training—Sight, Hearing, and Touch.		Thread or Seed Sorting. (*See Tuesday.*)			Object Lesson.		Sand Work.		Game or Story.	
THURSDAY.		Old Testament.						Thread or Seed Sorting. (*See Tuesday.*)		Number (Concrete).			Object Lesson.		Tracing Outlines of familiar Objects with Pins and Beads.		Nature Forms in Thread Laying.	
FRIDAY.		Texts and Hymns.						Clay Modelling.		Number (Concrete).			Sense Training.		Free Drawing.		Story or Game.	

their respective neighbourhoods, and send them to Goodrich Road. Mrs. Cashmore speaks in the highest terms of the kindness of these ladies in taking the trouble to send such quantities of flowers, and thus making a link between town and country which she would like to see further extended. In addition, the London School Board sends one of their fortnightly botany boxes filled with flowers, to be used as Mrs. Cashmore thinks best. They are not altogether wasted at the end of the lesson. Some of the best of the leaves are preserved by gluing them upon cardboard, and stored up, "busy bee-like," for the gloomy winter, to be then used as copies from which to paint and draw.

Having received free permission to go as I wished, I at once directed my attention to the Time-table to see how work is regulated, and I am permitted to provide our readers with a copy. This Time-table, together with that of the babies' class, has been published by the Board of Education; and the date should be noted, as no alteration has been made since then, and that Her Majesty's Inspector, the Rev. C. D. Du Port, has allowed very considerable latitude in its drafting.

Mrs. Cashmore's predominant idea is to develop the physical, intellectual, moral, spiritual, and social side of the education of her young charges by means of the artistic faculties; for she deems that the intellectual exercises alone are to these very young children essentially insipid and unattractive. They may impart to some, as exertion, a certain small degree of the delight that always attends the healthy action of exuberant faculties; but this rather comes later on in the senior departments, and is not a marked peculiarity in the commencing school career of the child. Freedom of action within due limits is everywhere seen in the school. As the young people play, so is their play studied and turned to good account. Children's one idea of life is to enjoy it; and Mrs. Cashmore—rightly, I think—con-

"MAKE WHAT YOU LIKE."

siders that, as the proper and principal end of art is enjoyment, whatever is able to contribute on the great scale to enjoyment is a power over all that we do.

DRAWN FROM NATURE WITH COLOURED CHALKS.

For the greater freedom of the child's muscles, we see him here in his class standing before millboards which are placed vertically in the desks, armed with a piece of chalk and a duster, and working at arm's length for the development, artist-like, of some shape which has either been suggested to him by his teacher, or is the outcome of his own imaginings. We see here no wretched ponderings over wearisome lines forming impossible natural shapes and Chinese puzzle designs enough to drive one to desperation, or the drawing of the free and unfettered lion and lamb hacked out in squares or distorted out of all reasonable shape and size. Mrs. Cashmore has abolished this style of drawing from her school, and the small checkered paper is not seen inside her building. Hers is one of freedom and individuality; hers the delight of Shenstone's village schoolmistress, who "sees in each sprite some various gifts appear." This encouragement of individuality is most noticeable, and the visitor is agreeably astonished at every point throughout the school. For discipline there is no effort apparent, but the children everywhere are orderly, attentive, and obedient; the youngsters know what they have to do, and, moreover, *like* the doing of it. Mrs. Cashmore is with Froebel in principle and spirit only. She is not orthodox so far as the Froebelian gifts and occupations are concerned; for she contends that what was intended to assist in the development of the individual cannot so well be applied to the mass, as every unit of the mass composing a class of seventy or eighty children has a separate individuality of its own, and Mrs. Cashmore has proved by her long experience of infants' schools that Froebel's gifts are not suitable for large classes.

Entering a room where singing is being conducted, we readily discover the subject of the song is the "Fisher Boy;" for in front of the class there beams the chromolithograph picture of a ruddy-faced, healthy-looking fisher lad holding in his hand a very fine specimen of a fish from the deep sea which he has evidently caught, whilst we are presented with a background of sea and sky. For the guidance of the little ones in their efforts to make a drawing, the teacher has ably drawn the chief lines of the copy upon the blackboard. In the song itself, which is known to most teachers, there are numerous actions introduced, so that the desire of the child for movement is satisfied.

Conducted into another room, where there is again a large class of between sixty and seventy children, this is the impromptu dialogue which takes place:—"Well, children, you are going to draw cherries. Which would you rather do—eat or draw them?"—"Draw them first, teacher." "Very good! And then you are going to *model* them. Well, shall I eat *them*, and you eat the *models?*" (*Omnes* with laughter) "Oh, no, thank you." With the cherries in hand they sang very sweetly, "Cherry Ripe;" and later on I saw and criticised the drawings, clay models, and paintings of the luscious little fruit. Each child places his tempting cherries on the left hand; the water, colours, brush, and paper are before him. No pencils are used, but the work is drawn in deliberately with the brush, the child mixing his own pigments to get his tints of colour. Crayons are also used; and in one class, where an object lesson—or, as Mrs. Cashmore prefers to call it, a "sense-training lesson"—is taking place, we find the children very busy with the pastels and their millboards endeavouring to delineate the gooseberry. A large drawing, filling the slate on the wall before the class, and representing the gooseberry with leaves growing upon a stalk, the colours just suggesting the natural ones, compels me to ask what are the art qualifications of the teachers on the staff. I was informed that only one teacher possesses the full "D;" and, as an artist and a teacher, I dare say that its non-possession has been beneficial in not driving out the artistic instincts of the teachers of Goodrich Road School.

Mrs. Cashmore aims at the development of the child's five senses; and she gives some amusing lessons, by making the children shut their eyes and touch some different characteristic substances, such as a brick, a slate, piece of marble, silk, cotton, wool, etc., and getting an answer from them as to what the touch is like. In the lesson now before us, the teacher is educing certain facts from the children con-

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DRAWING FROM NATURE WITH SOFT-COLOURED CHALKS.

In another classroom, which was rich with the delightful scent of honeysuckle, the infants were very busily employed in painting this flower in Japanese style, deliberately, with the play of the brush. Each child had its own little model before it; and at the interval for play it was my good fortune to go round the desks, carefully examine each exercise, and make comparisons with the original. I was particularly struck by the ease with which the childish artists had exercised their powers of selection, just drawing those parts which were most easily adapted to brush representation, and leaving out undesirable parts and difficult foreshortening. Truly, this is the outcome of very careful teaching and close observation, and reflects the highest credit upon those whose work it has been to draw out such powers.

For my edification, a little mite, with a flower in her hand, was stood upon the table for five minutes, and posed as a model for her classmates to draw from, and the result was very creditable and exceedingly amusing. This same faculty of observation is naturally carried outside the schoolroom, as I had remarked before entering the building, and we see it carried into play in the memory drawing of a clown in a torchlight procession, the omnibus and its occupants, etc.

When the weather permits, the geography lesson is occasionally given on a neighbouring hill a little way off, from which an extensive view of the hills around London can be obtained.* No reading lesson takes place without the aid of a picture of some sort to represent the subject-matter in hand. Pictures and diagrams are also taken to illustrate the arithmetical exercises; and so the art emotions are looked upon, not only as a mere source of enjoyment, but as a moral power and an aid to education at every point.

In the babies' room—and here we have been allowed to give another Time-table—we are introduced to what Mrs. Cashmore is pleased to term "art in the concrete." Pictures are everywhere on the walls, the room has a piano to itself, and the little ones are as busy as bees in a hive. Mrs. Cashmore never allows them to sit idle, and finds work for them immediately they enter, by placing before them plenty of things to occupy their little fingers. Sometimes they have about half a yard of cord of various colours, which can be twisted into various shapes to represent such objects as a sofa, a chair, a boot, etc.; or from a small pot of seeds of various kinds the tiny ones develop little patterns, and endeavour to display ingenuity in these and other directions.

Freedom of movement in drawing is carried on in the school from first to last. The drawing of a pig (free-arm) was carried on to the accompaniment of the following piece of poetry:—

HOW TO DRAW PIGGY.

The body of piggy
  Is shaped like a bean,
Except when he's poor
  And uncommonly lean.

Then give him an ear,
  And a long, handsome snout,
For the last is so useful
  In rooting about.

Then a bright little eye
  He must have without fail;
At the other end of him
  A small, curly tail.

Then give him four feet,
  And you have a whole pig,
Who can run for his food,
  Be he little or big.

The children here in this room sometimes have a lesson on form by giving out some "graphed" copies of a leaf of good design. These are placed on felt pads, and the children place the beads on the top of the outline of the drawing, threading them on pins, the heads of which are seen above the beads. The result is very effective, and the action produced is that of the simplest and first form of threading.

As no "three R" subject, as will be seen from the Time-table, is taken in the afternoon, I had not an opportunity of judging of that side of the work; but I understand that as many visitors go to hear the reading as those who go to see the kindergarten. Reading is taught on a method devised by Mrs. Cashmore, and is chiefly based on the phonic method, but differs from the usual phonic methods by starting first with long vowel sounds, and keeping to them until the child has begun to walk alone a very little way along the path for acquiring the power to read; for this is the aim rather

* A fully-illustrated contribution by Mrs. Cashmore appeared in our Number for February 1899, entitled "How we teach Geography."—Ed. *P.T.*

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Who can run for his food,
Be he little or big.

The children here in this room sometimes have a lesson on form by giving out some "graphed" copies of a leaf of good design. These are placed on felt pads, and the children place the beads on the top of the outline of the drawing, threading them on pins, the heads of which are seen above the beads. The result is very effective, and the action produced is that of the simplest and first form of threading.

As no "three R" subject, as will be seen from the Time-table, is taken in the afternoon, I had not an opportunity of judging of that side of the work; but I understand that as many visitors go to hear the reading as those who go to see the kindergarten. Reading is taught on a method devised by Mrs. Cashmore, and is chiefly based on the phonic method, but differs from the usual phonic methods by starting first with long vowel sounds, and keeping to them until the child has begun to walk alone a very little way along the path for acquiring the power to read; for this is the aim rather

* A fully-illustrated contribution by Mrs. Cashmore appeared in our Number for February 1890, entitled "How we teach Geography."—ED. *P.T.*

than the acquirement of a vocabulary. So successful has the method been found that Mrs. Cashmore says the children only spend from fifteen to thirty minutes a day, according to age, in reading, and the results are much better than when double that time was spent upon the subject.

The reputation of the school is very great, and a glance at the visitors' book shows us Sir John Gorst's name twice, and those of educationists from various countries, together with their extremely flattering remarks. One would think that its reputation had extended to the four corners of the globe.

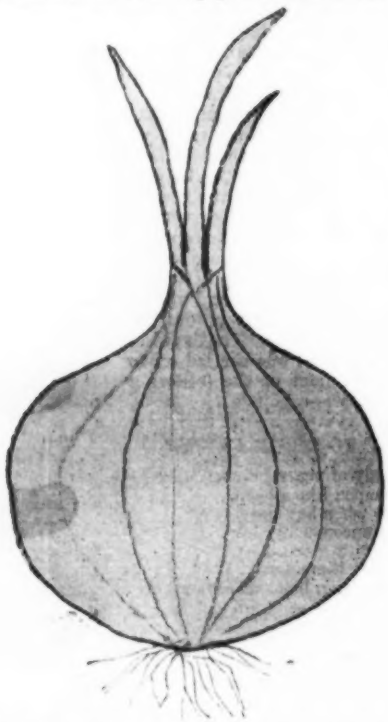
The Government reports on the school are such as to raise pride in the heart of the proudest, but Mrs. Cashmore bears her honours very modestly. I have selected a few :—

"All is remarkably perfect."

"All alike excellent in tone, contrivance, and teaching."

"A splendid infants' school, calling for neither criticism nor suggestion, but only for the highest praise."

Mrs. Cashmore has been engaged as head-mistress by the



DRAWING IN CONNECTION WITH OBJECT LESSONS.

London School Board for the past fifteen years. Strange to say, she was a pupil teacher at a girls' school near Stoke-on-Trent, and never taught in an infants' school until after she left St. Mary's Hall Training College, Cheltenham, to take up the headship of St. Mark's Infants' School, Birmingham, which post she held for two years, after which Mrs. Cashmore had charge of a very large school under the Birmingham Board, which she resigned to take charge of a still larger school under the adjoining School Board of Aston. The present results which she now shows are the outcome of much thought and experiment; and there is little wonder that Mrs. Cashmore points to them with pride. One can safely say that the little child in the first class has been encouraged to put forth his infantile powers to acquire some knowledge for himself, helped where he needed help, guided where he needed guidance, and thus his mind has been developed without being in any way strained or forced. He has taken pleasure in the exercise of his faculties, and, above all, acquired some love for learning, not only because it has gratified his awakened curiosity and saved him from idleness, but also because it has never been made a burden and terror by tasks or punishments.

THE ELEMENTS OF SCHOOL HYGIENE.

BY ARTHUR NEWSHOLME, M.D., F.R.C.P. (LOND.),

President of the Incorporated Society of Medical Officers of Health; Examiner in State and Preventive Medicine to the Universities of London and Oxford.

INFLUENCE OF SCHOOL LIFE ON EYESIGHT.

(*Continued.*)

ANOTHER symptom occasionally developed by hypermetropic or far-sighted children is a squint or cast in the eye. The origin of this is easily explained. We have already noted that with accommodation, implying contraction of the minute ciliary muscles, the internal rectus muscles contract, and cause the eyes to converge. These two sets of muscles are under the control of the same nerve (the third cerebral), and consequently act harmoniously together. When, however, the ciliary muscles are being overexerted, the internal rectus muscle of one or both eyes also begins to contract too violently, and an internal squint is thus produced. The squint is at first occasional, but soon it becomes persistent. It is worst when the child is tired, or after any illness. It is usually ascribed to some trivial cause, and often to imitation, though **in the vast majority of cases it is produced by a hypermetropic or long-sighted condition of the eyes,** and can be effectually remedied by the use of scientifically-adapted convex glasses. Let me urge, in passing, that any tendency to squint in children from four to seven years of age should receive early attention, as it can usually be remedied by the wearing of appropriate glasses. The exact condition of things in the hypermetropic can be studied by reference to Fig. 3 (see August number).

Myopia, or short-sightedness, is a condition of the eyes in which parallel rays of light are brought to a focus in front of the retina, owing to the elongated state of the eyeball. Consequently, in order that objects may be seen distinctly, it is necessary that they should be brought near the eyes, thus converting parallel into divergent rays of light. The same effect is produced by concave glasses, as shown in Fig. 4, and the proper remedy for near-sightedness is therefore the use of concave glasses.

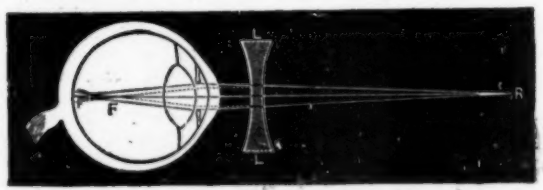


Fig. 4.

SECTION OF MYOPIC EYE.

R, The source of divergent rays of light; F, the focus of these in front of the retina; L L, concave lens to be worn by myopic scholar; F', the focus of rays of light on the retina, showing the influence of L.

The appearance presented by external objects to a short-sighted person may be understood by looking through an ordinary hand-lens, such as is used for examining pictures; only it must be placed close to the eye instead of at some distance. All external objects then become ill-defined; the general outlines may be visible and the colours of objects, but the details are not distinguishable. Out-of-doors the myope tries to

help his vision by facial contortions and by half closing his eyelids. Indoors no accommodation is required for near objects, as the rays of light are already brought to an early focus; but in order that he may not see double, it is necessary that the internal rectus muscles should contract. They are thus, by not acting along with the ciliary muscles (for accommodation), made to do more than their fair share of work, and become fatigued, and may even cease to act perfectly. Then double vision results, and everything is confused. The myope may accustom himself to use only one eye, in order to relieve the strain, in which case an outward squint is produced. It is commonly supposed that short sight diminishes with age. This is, however, a great mistake. Distant vision will be as difficult for the myope in old age as in youth. Near vision will, however, be more difficult, and thus old age can bring for the near-sighted only an aggravation of their troubles. The chief change attendant on old age is the loss of the power of accommodation—*presbyopia*.

Before considering the causes of myopia, it will be convenient to briefly consider the question of **Astigmatism**. In this condition the curvature of the cornea is not uniform, and consequently rays of light passing through it in different axes have a different focus. The lines passing in a given direction appear blurred. Children suffering from this condition often appear stupid and inattentive. They have what is called "slow sight:" a word is not recognised at first sight, but "it seems to come to them afterwards." Cylindrical glasses are required to remedy this defect, and these must be constructed by a scientific oculist who understands his work.

The **evil consequences** of defects of vision are not thoroughly appreciated. The interference with school work, the lack of progress of the child, is but one among many other serious troubles. The scholar's health begins to suffer. He has severe headaches, the cause of which is commonly overlooked. In severe cases other troubles may develop, and I perhaps cannot better describe these than by narrating the following case from the experience of a well-known ophthalmic surgeon:—

"The patient's father was a banker in a provincial town, and the son, who was an only child, had been intended to succeed to his father's business and social position. About eighteen months before I saw him, he was at Oxford, reading hard for honours, and with confident expectation of obtaining them. His work was suddenly interrupted by symptoms which compelled him to obtain medical advice, and which were attributed to some serious and alarming cerebral disturbance. He was directed to abandon his studies immediately, and not only to give up the idea of taking honours, but even to leave the university immediately, without aspiring to an ordinary degree. He returned home, and there the opinion given at Oxford was reiterated by his family attendant, and was confirmed by a consulting practitioner in the locality. He was for some time under treatment, but derived no benefit, and at last came to London for further advice. An eminent physician, since deceased, concurred in the view that had already been taken of the case, and pronounced absolute rest of brain to be essential to the patient's recovery. In order to obtain this rest, he was directed to undertake a voyage to Australia and back, and this direction he literally fulfilled. He went to Australia, made some brief stay there, and returned to England unimproved. He was then told that little or nothing more could be done for him; that he must abandon the idea of carrying on the family business, or of taking any active part in life; and that he must also abandon an engagement of marriage which he had formed prior to his illness. His prospects seemed utterly blighted, and he listened to his father's narrative with a careworn and dejected expression which was pitiable to see. The father concluded by saying that he had heard, from an unprofessional source, that oculists were in the habit of using some instrument by which they could see the state of the circulation in the brain, and that he had come to me in the forlorn hope that this instrument might throw some light upon the case.

"On inquiring into the actual condition, I was told that it was very 'peculiar.' The memory, the intelligence, the mental faculties generally, were all unimpaired, and at last I narrowed the case down to this—that the patient was unable to read. Before he had read a page, he became the subject of double vision, followed by vertigo; and also, if the effort was continued, by sickness, palpitation of the heart, and intense headache. These were the symptoms that had interrupted his work at the university, and they had ever since recurred almost as soon as he opened a book. When he had not been trying to read, he was in all respects quite well.

"On examining his eyes, I found that they were both myopic in the same degree, and that the far point was only eight inches from the cornea. The patient had binocular vision, and had never worn spectacles. With concave lenses of eight inches focal length, the distant vision was nearly normal. Beyond myopic crescents, the ophthalmoscope showed nothing amiss.

"With these data, the condition of the case began to be manifest. The patient had never been able to read from a book which was more than eight inches from his eyes, and had generally held it still nearer, say at seven inches. The internal recti muscles, therefore, were required to maintain convergence of the two optic axes to a point only seven inches distant. Up to a certain period they fulfilled this requirement, but they broke down under a stress of work which was imposed upon them by reading for honours. The muscles became tired, they relaxed suddenly, and, as a matter of course, the two eyes being no longer directed to the same point of the page, the lines and characters would appear doubled. It is probable that the whole system was somewhat overwrought; but the transitions from double vision to vertigo, from vertigo to faintness, sickness, and palpitation, and from palpitation to headache, are easily intelligible. The muscles, having once struck work, rebelled against even a short period of convergence; and the grave view taken of the symptoms by medical authority added anxiety and emotional excitement to the pre-existing elements of the case.

"My prescription was very simple. I explained the view I took of the case, and told the patient he had nothing whatever the matter with him. I ordered two pairs of spectacles—one of eight-inch concaves, to be worn from morning to night, except when reading; and one of fourteen-inch concaves, for reading only. The book was never to come nearer than eighteen inches, and the patient was to read three half-hours a day, at three different times, and to come and report himself in three weeks. He and his father listened to me with polite incredulity, but they probably thought the advice worth trying, and they procured the spectacles. On that day three weeks the young gentleman returned alone, his spectacles on his nose, his front erect, his whole figure expanded, his countenance beaming. He said, 'I have come to see you again because you told me to do so, but I have nothing to say except that I am quite well; I am going to be married next week, and to set to work at the bank as soon as we return from the wedding tour.'"

Next as to the causes of defects of vision, and more particularly of myopia. We have seen that astigmatism and hypermetropia are congenital, and not connected in their origin with school work. Myopia, however, is very commonly ascribable to school work under unfavourable conditions. It is frequently hereditary, so far as the tendency is concerned; the children of myopes are especially prone to become myopic. It is not, however, certain that children are born myopic, only that the tendency to myopia is transmitted from parent to child. Whatever be the opinion held on this point, there is little doubt that **short sight is chiefly developed during school life.** It is still more certain that there is no cure for short sight. Concave glasses may prevent the development of those secondary conditions which sometimes even destroy the power of vision, but the short sight itself cannot be cured. It is therefore of supreme importance to ascertain the causes of short sight, in order that efficient preventive measures may be taken. Before discussing these, a word to teachers on the importance of the **detection of these defects** of vision. A child's lack of progress in school work may be entirely due to his defective vision. It is not necessary for the

teacher's purposes to distinguish between the various forms of defective vision. In passing I may draw attention to deafness, as a neglected and ofttimes overlooked cause of stupidity at school.

Now as to the causes of myopia in connection with school life. We have seen that, in the healthy eye, distant rays of light are brought to a focus on the retina without any effort of accommodation. Among races and families who have never been schooled short sight is absolutely unknown. Civilisation, however, has increased the number and the complexity of the occupations which necessitate the use of the eyes at a short distance. In the adult this is not usually followed by any evil results. But with children the case is different. The universal character of our school education involves that every child from the age of about five to thirteen shall be brought under tuition, involving prolonged strain upon the eyes, at a period when they are not fully developed, and when the tunics of the eyes are soft and compressible. The consequence is that the muscular pressure on the tunics of the eyes causes them to elongate from before backwards, and myopia is produced. But the amount of myopia developed during school life varies greatly in different countries. It would appear therefore that school life does not necessarily involve its production, but only when it is carried on under unfavourable conditions. In Germany it has been extremely common; in this country comparatively rare, though apparently on the increase. In 1865 Cohn of Breslau examined 10,060 children, and found the frequency of myopia to be as follows:—

In 5 village schools	1·4 per cent. of children myopic.
In 20 elementary schools	6·7 per cent. of children myopic.
In 2 higher schools for girls	7·7 per cent. of children myopic.
In 2 middle schools	10·3 per cent. of children myopic.
In 2 real (high) schools	19·7 per cent. of children myopic.
In 2 gymnasia	26·2 per cent. of children myopic.

Out of the total 10,060 children examined, 9·9 per cent. were myopic, while 239 (2·9 per cent.) were hypermetropic, and 23 had regular astigmatism.

We may draw several conclusions from these important figures—namely, (1) that in village schools the percentage of short sight is very low, while (2) in the town schools it is much higher, and (3) the number of short-sighted children constantly increases with the grade of the school, from the lowest grade to the highest (*Cohn*).

That the myopia develops under the influence of school life is shown by the increasing percentage with age. Of 634 divinity students examined by Dr. Gärtner at Tübingen, 79 per cent. were myopic. Among medical students, Cohn found the proportion of myopes in the first year of study 52 per cent., and in the last year 64 per cent.

In the United States 1,479 scholars were examined, the number of myopes rising from 10 per cent. in the lower schools to 28 per cent. in the higher colleges. Dr. Derby found 28 per cent. to be myopic at Amherst College, Boston, and 29 per cent. at Harvard University. It is evident from these few examples that in every country the number of short-sighted scholars increases with the requirements of the school and with the standard to which education has reached. In England statistics are less abundant, but in Birmingham 5 per cent. of 1,600 school children examined were found to be myopic, and 20 per cent. of teachers at the training college in the same city (*Priestley Smith*). It is certain that myopia is *less prevalent in England than in Germany*. In all probability the excess in Germany is ascribable to the fact that school training until the last few years was more universally enforced in that country than in ours; that their school hours were much more protracted; that the type of their books is more trying, and the hygienic conditions of warming and lighting of schools, and the arrangements of their desks, even worse than those found in this country.

I have already mentioned one of the chief determining causes of short-sightedness—namely, the **prolonged use of the eyes on near objects**, involving a strain upon the accommodating apparatus, and a tendency for the eyes to become elongated. The teacher has it in his power to do much to remedy this evil. He can so alternate the lessons as to follow reading or writing lessons by others in which the blackboard only is used, and in this way, while he saves the children's eyes, secure the greatest amount of work from his scholars. It would be well if the blackboard were much more extensively employed than at present. Protracted home lessons have been much overdone. The centre of gravity of learning should always be in the school itself. The ideal home lesson is one which recapitulates or recalls some portion of the day's work, but does not involve prolonged and close application. It should be remembered that the scholar at home is not uncommonly placed under much more unfavourable conditions for learning lessons than at school. The light may be defective, and may come from a lamp, which irritates the eyes and heats the head and causes headache. The arrangements for writing are such as are not well adapted for the scholar's needs, the chairs or the table being too high; and the atmosphere is often vitiated, and thus an unfavourable environment is produced which is very fertile in the production of defects of vision.

Bad postures intensify the tendency to the production of myopia. And here we get into an evil cycle. Short-sightedness necessitates the holding of the book near the eye, and if the book or copy must be placed on the desk, the scholar is obliged to lean closely over it. Thus short-sightedness produces bad postures, and may even lead to the production of curvature of the spine; while, on the other hand, bad habits in holding the book too near the eyes may lead to the production of short-sightedness, and when once started each condition tends to intensify the other. Lateral curvature of the spine in 90 per cent. of the cases is developed during school life, and is doubtless favoured by the unfavourable conditions under which the scholar works. One of the most fertile causes of twisted spines is a badly-arranged desk. But let me not be misunderstood on this point. Spinal curvature may be produced with the most perfect desks, and may usually be avoided even though the desks are badly arranged. Long continuance in any cramped or improper position will be followed by bad results; and in order to avoid this, teachers should during school hours take their scholars at intervals through drill exercises, which not only increase the tone of the muscles, and thus form an admirable means of preventing spinal curvature, but in addition quicken the circulation and prepare the scholars to attend more carefully and thoroughly to the subsequent lesson.

The consideration in detail of the subjects of school desks and seats; of special work, such as needlework; of defective lighting of the schoolroom, and whether due to defects in the school itself or in its environment, must be left to a later article.

Our Monthly Retrospect

EDUCATION IN ENGLAND.

N.U.T. NOTES, ETC.

BY T. B. ELLERY, F.R.G.S.,

President of the National Union of Teachers, 1895–96.

The Recent Certificate Examination. MANY complaints have been received concerning the arithmetic paper set to women—second year—in the recent Certificate Examination. It will at once be conceded, of course, that the tests given should be searching, and such as will distinguish between the indifferent candidate and her more able and studious sister; but, on the other hand, the questions should be reasonable and useful—they should not be *puzzles*. No one needs to be told that it is possible to set a mathematical paper which will place the student who is "good at figures" at as great a disadvantage as one who is less able and less industrious. Whether that was the case in the recent Certificate Examination (Arithmetic, Second Year Women) is a question which has been discussed during the past few weeks in many places and by many people.

After a careful examination of the paper, one is driven to the conclusion that a more useful and perhaps a more reasonable set of questions might have been drawn up, though, it is but fair to say, exception cannot be taken to the majority of the problems proposed. What the examiner appears to have forgotten is the fact that he was setting questions *for young women*. The three alternative algebra tests were by no means difficult, nor did they involve the use of many figures, if the students had but an elementary knowledge of factors.

The Questions under discussion. The questions complained of in one quarter or another are as follows:—

"1. What maximum start in a mile race ought a cyclist, whose record is 3′ 15″, to give to another whose record is 3′ 20″, assuming that the pace of each is uniform over the course?

"2. In old style, the mean solar year was 365¼ days, but in new style, introduced in 1752 A.D., three leap years in four centuries were omitted. Find the average length of a year in new style. If the year be taken actually to be 365·242218 days, show that the accumulated error in new style will not amount to one day in the year 5252 A.D.

"3. How would you teach scholars who understand square measure whence the 27 in cubic measure comes? Two tin boxes are flat and *square* at the bottom, and have upright sides; one is 9 inches broad, the other less. The same quantity of flour will fill the broader box to a depth of 3¼ inches, or *both* boxes to the depth of 2¼ inches. Find the area of the bottom of the smaller box.

"4. Of two square fields, one contains 10 acres, while the other is broader by 1 per cent. Find the difference in area, expressed in yards, feet, and decimals of a foot.

"5. A man invests a sum of money in a stock at 91, and an equal sum in another stock at 117. After some time the prices of the stocks have exchanged values, when the man sells, and finds that he has made a profit of £52. What sum did he invest?"

Head-masters of pupil teacher centres and principals of training colleges are, perhaps, the best judges in this matter. If, in their opinion, the questions quoted above are too severe *for women*, representations to that effect should be made to Sir George Kekewich, who is not the man to permit an injustice to be done, if he is once convinced there is an irregularity of any kind.

The Punishment Book. The compulsory institution of the "Punishment Book" is to be regretted. Teachers generally have no objection to the amount of corporal punishment inflicted in their schools being known; but it is a sign of mistrust when the Board of Education orders a record to be kept, and it is this evident want of confidence which is so keenly resented. Teachers do not perhaps discuss the matter in public, for they probably would not be understood, but they feel the indignity all the same.

It requires a certain amount of courage to stand up in open meeting and protest against such an obnoxious and totally uncalled-for minute, but sooner or later the duty must be undertaken.

Will *all* punishments be entered in every school? If not, it is more than possible that one teacher may be compared with another, to the disadvantage of the man who is doing his duty under particularly difficult circumstances, and who does not shrink from entering everything, from the slight tap to the more severe form of punishment for grave offences. "These entries," says Mr. Oliver, H.M.I., "should be useful as evidence in magisterial cases." Comment is needless; but one is glad to hear Mr. Oliver say, "Personally, I attach little importance to the Punishment Book."

Teachers generally do all in their power to make the school interesting and attractive, and resort to the cane only when compelled to do so. It is to be feared, however, that when parents and children are aware of this new regulation, certain of the former will become more suspicious, and the worst among the latter more defiant and unruly. That is the danger.

Matriculation Examination: Hearty Congratulations. All members of the Union will heartily congratulate Mr. T. A. Organ, B.A. (Standing Counsel, N.U.T.), and Mr. T. F. Bowers, B.A., member of the Executive, upon the fact that their sons have distinguished themselves in the recent Matriculation Examination, London University, both lads having obtained a first-class. If the young undergraduates follow in the steps of their respective fathers, all will be well. Mr. Organ's services in the Law and Tenure departments at Russell Square are too well known to need mention here; while Mr. Bowers, in addition to his Executive duties, manages to find time to act as chairman of the Relief and Loans Committee of the Orphan and Benevolent Council.

With such examples before them, and with such an excellent start as they have made in the University examination, the sons should have a bright future in store.

The Boys' Orphanage. At the last meeting of the Council of the Benevolent and Orphan Funds, Mr. B. South, the Manchester enthusiast, moved, "That this Council recommends the House Committee to take into consideration at once the desirability of appointing a man to take charge of the Boys' Home." Mr. Harry Coward was down to second the motion, but he was, unfortunately, unable to be present at the time. An able substitute, however, was found in Mr. David H. Hodge, who made an excellent speech in support of the suggested change. The ladies were somewhat divided—Miss Hawley (Leicester) being in favour of the motion, and Miss Cleghorn (Sheffield) thinking it premature. In an effective speech, Mr. Wells strongly opposed the proposal, and at that point the debate was adjourned. There is no doubt there will be a great division of opinion upon this question, for many things have to be considered, not the least being that of the expense of some of the changes suggested by one or two of the speakers.

The Birkdale Tenure Case. This case, the details of which are so well known, appears likely to end satisfactorily. Indeed, the latest report, at the time of writing, is that the difficulty is over; that Mr. Syddal will be called upon to

resign, and that all the assistants who, acting on the advice of the Executive of the N.U.T., resigned, will be reappointed. The details of the settlement will form very interesting reading. It is reported that the discussion at the meeting of the Board when the vote was taken was an acrimonious one, and that the motion was carried by a bare majority, one of the speakers declaring that the action of the N.U.T. constituted a menace to all schools.

TECHNICAL AND SECONDARY EDUCATION.

"The Education Bill, 1900." The anticipations respecting the Bill have been fully realised. An academic discussion took place on the second reading in the House of Lords, on the 23rd July; while at the same time, the week previous, the Leader of the House of Commons intimated that the Bill would not be proceeded with this session. Every one seemed impressed with the inadequacy of the measure for the purpose of placing on a satisfactory basis the question of secondary education. The introduction of the denominational question, and the thorny one of giving aid to "private profit" schools, would have proved an insuperable barrier to the acceptance of the Bill by the House of Commons. The absence of any definite line of policy on the part of those most interested in the progress of education, and the conflicting opinions of the various sections of educationists as to the local authority, will, however, prevent any combined effort to make out of the Bill, when reintroduced, a really good measure. In this crisis a strong federation council would have proved of immense advantage in determining the lines of policy upon which united action could have been taken. Such a federation council may be in existence before the parliamentary session of 1901 sees the introduction of the same or an amended measure.

The London School Board and Higher Elementary Schools. Lord Reay took the opportunity of condemning the action of the Board of Education respecting its treatment of the London School Board in the matter of higher elementary schools, and plainly declared that it was impossible to draw the line between primary and secondary education, notwithstanding the regrets of Lord Norton that an attempt to do this was not made in the Bill. He also declared boldly for subjects such as history, literature, and modern languages as the most suitable for the purpose of a good secondary education of to-day, rather than the dead languages, which are supposed by some to be the sole means of giving culture to the intellect of the scholars in secondary schools.

A Federal Educational Council. An outcome of suggestions made at the Imperial Institute Conferences in connection with the Educational Exhibition in January last, was a meeting held at the College of Preceptors on the 30th June last. It was then decided to establish a permanent council, consisting of accredited representatives of existing educational bodies, able to speak in their name, yet not interfering with their individual efforts; and a committee was appointed to consider questions of finance, representation, and the constitution of the council. The principles underlying the constitution are—the avoiding of individual attempts to control educational policy affecting large bodies of teachers and many diverse institutions, and the consideration of broad issues affecting all classes of people interested in education. The heterogeneity of the proposed council will secure the consideration of general principles rather than individual interests, and it is hardly conceivable that it can possibly ever override existing associations. Contact with other bodies in such a federation must tend largely to broader sympathies and less narrow and selfish views than those which isolation is apt to foster. Unity of education without the cast-iron regulations which often bind separate interests, the avoiding of misunderstandings and mistakes in policy, and the maintenance of education free from political interests, may be looked for as the results of the establishment of such a council as is foreshadowed.

The Pious Founder. It has been supposed that the pious founder was extinct. The late gifts to the new Birmingham University are undoubtedly evidence that such is not the case. The raising of £300,000 for the purpose of its establishment has been followed by two noble gifts during the past month—one of land worth £20,000, as a site for the new science buildings, and another of £50,000, for the buildings themselves. Students in the Midlands may prepare for the first matriculation examination, which is to be held in September next. The new principal is Professor Oliver J. Lodge, the eminent physicist. The various faculties have been constituted, and the university may be said to be launched on what will prove a most prosperous career.

The Charity Commission and the Board of Education. An Order in Council has been made, and we are now aware what are the powers transferred from the Charity Commissioners to the Board of Education. These are the powers of (1) inquiring into charities; (2) requiring accounts and statements to be rendered, and answers to questions returned; (3) requiring copies of and extracts from documents to be furnished; (4) searching records; (5) requiring the attendance of witnesses and the production of documents: and (6) examining of witnesses on oath—under the Charitable Trusts Acts.

Also the powers of the Charity Commissioners under the Endowed Schools Acts, 1869–1880, except such as relate to the vesting or transfer of lands or funds; the powers relating to endowments; the appointment and removal of trustees, or the constitution of the governing body of any endowment held partly for educational purposes, if administered by a body established for educational purposes. This transference seems fairly to cover the field of education now administered by the Charity Commissioners.

The Technical Training of Teachers. After a little over twelve months' trial, the London School Board has discovered that the "half-time" system of preparing ex-pupil teachers for the Certificate Examinations is not satisfactory. A large proportion of the students break down under the treble strain of teaching half the week, attending lectures the other half, and the needful preparation for the lectures entailed upon them during the whole week. The superintendent finds it impossible to superintend the students' practical work effectively, and his helper gives up in despair at the vast amount of labour imposed upon him. In view, therefore, of the great need for more and better trained teachers, the Board has memorialised the Board of Education for permission to establish a day training college, which shall not be a burden to the rates, but shall give effective technical training to those whom it wishes to employ. In view of the promises made by the Vice-President, Sir John Gorst, it is possible the memorial may be successful, and a Board day training college be established.

The differentiation in the training of teachers is strongly urged by Mr. Scott Coward in his annual report just published. It is known among many that he has held the opinion for years that, for the good of the country schools, it would be well if a less elaborate curriculum were adopted for the training of teachers who are to work in country schools. However much may be said in favour of the practical acquaintance of teachers with rural pursuits and requirements, it would be a pity if such a differentiation in training became general. It would argue ill for the welfare of teacher and scholar if the former were not equally well qualified for town and country. The root of the evil lies in the fact that country managers cannot pay salaries to tempt teachers to take country appointments. The remedy lies in increasing the income of country schools. The Government, which gives 5s. 9d. per head aid grant to town schools, and only 3s. 3d. to country schools, has not grasped the elementary principles which lie at the root of the defects in our system. Practical teachers who have the training and the welfare of pupil teachers at heart should watch carefully the tendencies towards this limitation of the possibilities for both teacher and scholar.

EDUCATION IN SCOTLAND.

E.I.S. NOTES, ETC.

BY JAMES PATERSON,

Ex-Vice-President of the Educational Institute of Scotland.

Presentation to Mr. Blair, Science and Art Inspector. Mr. Robert Blair, M.A., B.Sc., who has for a number of years acted as inspector of science and art schools in the southern district of Scotland, was lately entertained and presented with an illuminated address by a number of science and art teachers in the east of Scotland, in recognition of his services to education, and his appointment as chief inspector of the technical instruction schools in Ireland.

New Inspector. Mr. Frank W. Young, F.R.S.E., F.C.S., headmaster of the science department of Dundee High School, has been appointed to an inspectorship under the Scotch Education Department. Mr. Young is to have charge of the science and art work in the western division of Scotland, with Glasgow as his headquarters.

Glasgow Teachers' War Fund. The subscriptions to the Teachers' War Fund initiated by the committee of the Glasgow local association of the E.I.S. now amounts to £325, 7s. 6d. The proceeds of the fund have been handed over to *The Glasgow Herald* Shilling Fund.

Training Colleges of Scotland. Dr. Stewart, H.M. Chief Inspector of Schools, and Inspector of Training Colleges in Scotland, in his first annual report on training colleges, condemns the internal arrangements in several of them. In view of the fact that denominationalism has practically disappeared from the Presbyterian colleges, and in view also of the increasingly close connection with the universities, involving some complication in the adjustment of time-tables, Dr. Stewart has formed the impression that it may in the near future be possible to place these colleges under a joint board of managers, consisting of representatives of the university and of the Presbyterian churches. In that case the male and female students could be taught in separate training colleges, and this, Dr. Stewart thinks, would probably be an advantage from more than one point of view.

Training College Practising Schools and their Staffs. One would naturally expect the training college authorities to set a good example to the School Boards of the country in the matter of the treatment of the teachers employed in their practising schools. If this were invariably the case, we would not hear of a teacher being at once dismissed on her being placed on a Board's list for prospective appointments, even although a whole year might elapse before her services would be required by the Board; nor would we hear of a student being advised against applying for an appointment on the ground that the salary was inadequate, while one of the best students had been selected for service in the practising school of the same college, at a salary considerably smaller than that offered by any School Board in Scotland for some years past. When these things are done in the green tree, what may be expected in the dry?

Edinburgh Teachers' Tribute to their Ex-Chairman. To mark the close of a pleasant official relationship, and to congratulate him on receiving the honour of knighthood, the late Chairman of the Edinburgh School Board, Sir Colin G. Macrae, has been presented by the teaching staff of the Board with a congratulatory address and a silver casket. Sir Colin was a member of the Board for fifteen years, and its chairman for nearly ten; and by his wide knowledge of educational systems, his liberality of mind, his unfailing kindliness, courtesy, and tact, and his single-minded devotion to the public interest, he won the confidence and esteem of the teachers, and all who have at heart the welfare of education in the city. Sir Colin, in acknowledging the presentation, discussed the conditions of the teacher's work, and gave his audience some excellent advice.

St. Andrews L.L.A. Examination. The results of the St. Andrews L.L.A. Examination for 1900, which was held at numerous centres in Great Britain and Ireland, France, Germany, Belgium, Switzerland, Natal, Cape Colony, Italy, Malta, New South Wales, and the United States of America, have lately been issued. It appears that 980 candidates entered for examination at eighty-four centres, and that from the commencement of the scheme in 1877 there have been in all 5,108 candidates. One hundred and thirty-six candidates have this year completed the requisite number of subjects, and will receive the L.L.A. diploma of the university.

University of Edinburgh Local Examinations. The secretary of the Local Examination Board of the University of Edinburgh intimates that, owing to the steady decline in the number of candidates at the local examinations, due to the institution of the Leaving Certificate Examinations of the Scotch Education Department, the Board's examinations will be discontinued after June 1901. All candidates who desire to complete their examinations, or to add to their certificates, must present themselves at that time.

CLASSES FOR THE FURTHER INSTRUCTION OF TEACHERS UNDER ARTICLE 91 (*d*) OF THE CODE.

Circular 234. The new demands of the 1899 Code are so great that it has been found necessary on the part of the Department to make arrangements for teachers acquiring the necessary knowledge and skill. This circular seeks to remove the misapprehension regarding the nature and object of the classes to be conducted under Article 91 (*d*) of the Code.

Nature and Object of the Classes. These classes are not to be confounded with classes conducted under the *Science and Art Directory*. They differ in two respects: they are intended (1) for the further instruction of teachers, and of teachers only; (2) not simply for the acquisition of knowledge, preparation for the examinations of the Science and Art Department, or the obtaining of qualifications as teachers under the *Directory*, but for the *training* of teachers with the direct object of rendering the instruction in such subjects as drawing, nature-knowledge, manual instruction, etc., in the schools of the district as efficient as possible.

The course of instruction in these classes should be specially designed for the object in view. A programme is to be carefully prepared and submitted for the approval of the Department. The instructors must not only have special knowledge of or skill in their particular subjects, but must also be competent to give advice and direction as to the best method of conducting such studies in schools, and, if necessary, to illustrate their methods in practice.

Financial Arrangements. The authority undertaking these classes must have funds to defray the whole expenses in the first place; but on the satisfactory completion of the course, a grant, amounting to not more than three-fourths of the actual expenditure after deduction of the income from fees, will be paid by the Department. The local authorities must finance the rest.

Inspection. The classes are to be visited from time to time, on behalf of the Department, by an officer deputed for the purpose, who is to make a report on the work of each individual student at the end of the course. The character of the work, the observations of the instructor thereon, and, if it is thought necessary, supplementary tests—oral, written, or practical—are to be taken into consideration.

Credit to be given for satisfactory attendance and work. The names of all teachers who have attended a recognised class, and whose work is favourably reported on, will be recorded in the Department, and credit will be given for such attendance and work in connection with any requirement of qualification for the teaching of certain subjects. With reference to *drawing*, satisfactory attendance and work at a recognised course of instruction of sufficient length will be held to constitute a qualification to earn grants for drawing in terms of the footnote to Article 19 B. 4 of the Code, and in lieu of the certificates mentioned there.

The time of the classes is left to the local authorities. A very valuable appendix follows, dealing with the general principles which should be kept in view in such classes.

NOTES FROM THE NORTH.

The Professional Status of the Teacher. MANY indications are not wanting that in our educational, but especially in our professional, affairs we are rapidly approaching a period of paramount importance. Events are at present in a state of flux; we are passing, if we have not already passed, through the transition stage. The air is filled with persistent rumours of far-reaching changes impending, especially with regard to our pupil teacher and training college systems. We hail, therefore, with much satisfaction the opportune appearance of the interesting pamphlet just received on "The Professional Status of the Teacher," in the hope that it may materially help in concentrating attention on some of the professional problems rapidly ripening for solution. The pamphlet contains the address delivered to the Edinburgh Branch of the E.I.S. by Dr. J. Gunn, the retiring president.

In the belief that many of our readers will be greatly interested in these questions, we take the liberty of giving a synopsis of the paper.

Is Teaching a Profession? We, as teachers, claim to be a profession. Our claim is sometimes disputed. But teaching is a profession just as much as preaching, or as the treatment of men's bodily weaknesses in disease, or of their mental weaknesses in lawsuits. But, he maintains, when the further question arises, "Is the teacher recognised as a professional man?" we are apt to find the answer surrounded with certain limitations and conditions. While it is clear that the teacher is a *bonâ-fide* professional man (or woman), with all the claims to consideration and emoluments which professional status implies, it is equally clear that this status and its accompaniments are often grudgingly granted, or practically denied.

The teaching profession does lack some things which other professions possess.

He then goes on to consider what these things are, and how such disabilities may be got rid of in the future.

What a Profession implies. Without attempting to define the term *profession*, Dr. Gunn considers that a fair working conception of the term may be got by thinking of the so-called "three black Graces"—Law, Physic, and Divinity.

(1) Education. In the first place, the term seems to imply a university education, or a technical education of a similar rank. Every teacher in the profession hopes to see the time when every young teacher shall receive a university education and a technical education of the first rank. That is coming. To many it has already come; but, as members of the Institute, he holds it is our duty to do all in our power to make it universal.

The Institute is not a private association of teachers; it is incorporated under a Royal Charter, granted over fifty years ago to some of the keen-sighted, broad-minded "old parochials." This Royal Charter was granted to teachers associated "for the purpose of promoting sound learning, and of advancing the interests of education in Scotland." That is the first duty of members of the Institute. The simplest way of promoting sound learning in the country is to secure sound scholarship and training in the teacher. And whatever furthers this end will raise the professional status, and eventually the professional rewards, of the teacher.

This would involve increased expense, and some would hold that the Government grant should only be applied so as to secure the minimum necessary to qualify teachers for work in elementary schools. He asks if it is necessary that the training of teachers *should* be undertaken by the Government any longer. In a transition time such was necessary to force forward the natural tendencies whose work would have been too slow to meet the demands created by legislation.

(2) Admission of New Members. The next point with regard to a profession he emphasises is, that it is the essential privilege of a profession that the members of it have the right to admit new members to that profession, either by certificate granted on examination, or by the registration of qualifications certified by other bodies. This is the case with the doctor, the lawyer, and the minister, and at the first glance it seems as if the teacher were in a similar position. He too must have his certificate, either actually or potentially as a probationer, whatever degrees he may hold. But this certificate is not granted by those who should be best qualified to judge of the conditions necessary for a teacher. It is granted by a Government department. It does not certify that he is admitted a member of the teaching profession. It does not recognise the existence of such a profession. Whatever its terms may be, its meaning is simply that the holder is qualified to earn Government grants for his employers by teaching in a public school. It does not even specify his attainments, but only his success in a certain Government examination. It records his training college course, but ignores his university career. It is simply a licence to earn grants under the Code. It was always an anomaly, and may surely, he thinks, be now regarded as an anachronism.

The Charter of the E.I.S. Dr. Gunn then goes on to deal with the better way. As a profession, it may be assumed that it should be our privilege to admit members into the profession, and to settle the conditions under which they may be admitted. This is not a visionary idea or an impossible demand. In fact, the Educational Institute of Scotland already has the power conferred upon it by its charter, and was originally incorporated largely for this purpose.

In support of this view he quotes the charter, which runs thus: "And also of supplying a defect in the educational arrangements of that country, by providing for the qualifications of persons engaged, or desiring to be engaged, in the education of youth in that part of our dominions, and thereby furnishing to the public, and to the patrons and superintendents of schools, a guarantee of the acquirements and fitness of teachers for the duties required of them, and thus securing their efficiency, and raising the standard of education in general." In the preliminary statement in their rules and regulations, the dominies of half a century ago inserted this: "It is expedient that the teachers of Scotland, *agreeably to the practice of other liberal* professions, should unite for the purpose....." This makes quite clear, he maintains, the views of the founders of the Institute. They aimed at giving the Incorporated Teachers of Scotland the right, which is enjoyed by other liberal professions, of forming a chartered corporation analogous to the General Medical Council, or the Faculty of Advocates, or the Presbytery of the Church, in its function of admitting into the profession those found to be duly qualified.

The Educational Institute has been so busy doing its duty to education that it has not as yet been able to enjoy its privileges as a profession.

The Board of Examiners. There is the Board of Examiners, a list of honoured and honourable names, of which no profession need be ashamed. Their work consists of examining and reporting on the qualifications of those who are recommended for the title of Fellow of the Educational Institute. But as Fellows are usually teachers of twelve years' standing, this can hardly be regarded as admitting new members into the profession. They also examine candidates for the Preliminary Medical Examination. This is quite legitimate, and in accordance with the spirit of the charter; but it is not, Dr. Gunn thinks, the work for which the Board was originally constituted. He does not wish, he says, to cast any blame on the Board of Examiners, nor on the Institute; but he does wish to point out that, through circumstances over which they had no control—circumstances consisting of Acts of Parliament, Minutes of the Privy Council, and Codes of the Education Department—the Institute and its Board of Examiners have not yet begun the work which they were empowered under the Royal Seal, fifty years ago, to undertake.

Is there, he asks, any possibility of our really obtaining this right to certify for admission into our profession those desiring to become teachers?

Signs of the Times. He thinks there is a possibility, even a probability, if the Institute rises to the occasions that present themselves, and aims high enough. He gives one or two indications. Last year there was published a very significant letter from the Department to the authorities of the training colleges. That letter made this point

clear, that the Department were willing to grant very free options to the training colleges as to their curriculum, and even to accept to some extent their college certificates as evidence of attainments. But one thing must be guarded against here, he says—namely, that there shall be no underselling of each other in the matter of certificates among the ten colleges in order to attract students. With such college certificates there must be a Board of Examiners, whose presence would be a guarantee of the level of attainments witnessed by these certificates. These assessors or examiners should be appointed by the Institute, as the charter broadly hints.

The Department are dimly conscious that it ought not to be their business to admit men to the teaching profession; it ought to be the business of that profession itself. This is one of the indications from which Dr. Gunn concludes that the charter may yet become something better than a mere parchment, and may have a real value to the profession.

Another sign of the times he mentions—namely, that in the Scotch Code for 1900 the Educational Handwork or Sloyd Association of Scotland is recognised by the Department as entitled to grant certificates qualifying persons to act as teachers of Sloyd or woodwork in schools. Similarly, other practical and technical associations are recognised for special purposes. There is, therefore, no new principle involved when we claim that the general body of teachers should similarly certify all teachers in our schools. The principle is already conceded by the Department. So far, however, the Institute has not showed itself alive to the importance of extending the principle to the profession generally.

Affairs in England. He would have us watch closely educational movements in England, and, in view of the value of his remarks at this point, we desire to give them *in extenso*:—

"The Education Department and the Science and Art Department have passed away; or, at least, if they have not really passed away, they have died officially and been immediately reincarnated under the title of the Board of Education. Among the many duties of the Board of Education, there is entrusted to it the preparation of a Register of teachers. This seems a simple enough matter, but it will not be accomplished without much tribulation. There are so many interests involved, and so much difference of opinion as to the proper definition of the word *teacher*. Whatever course may be eventually followed with regard to teachers now in actual work, in the future two essentials will be insisted upon by the Board of Education in order that a person be registered as a teacher: he will have to show evidence of, first, a competent education, and, second, a professional training. And no one who is unregistered will be regarded as a member of the profession, whatever be his education and his training.

"Now, these provisions are so far excellent. There is only one thing lacking. The professional Register should be in the hands of the profession itself, and not of any Government Board. In England, however, there is no professional body really competent to undertake this work of registration. Elementary teachers have their great National Union of Teachers, their National Association of Voluntary Teachers, and so on. Secondary teachers have their College of Preceptors and their Head-masters' Association. Sectional interests are better represented than general professional interests; indeed, elementary and secondary teachers seem each to have some doubts whether the others are really members of the profession at all.

"In Scotland, happily, the profession is less divided. The secondary teachers are recruited from the elementary teachers' ranks. The elementary teacher is not necessarily regarded as an uneducated person, and the secondary teacher does not consider training as a useless accomplishment for him. The Educational Institute has always represented the best interests of every class of schools, and its charter gives it a right to represent the whole profession, from the university professor to the teacher of the rural school.

Registration. "Soon the idea of registration will spread to our side of the Border. Then the question will arise, What is to be the registering authority? Who is to decide on the qualifications necessary for registration? To this question, again, the Institute can give only one answer. This work of registration is really one form of the work for which this corporation was instituted. Our Board of Examiners is a body legally constituted for the purpose of undertaking precisely this kind of work. We shall have to see to it, however, that the duty and privilege does not slip through our fingers and fall into the hands of some usurping Board or Department. And unless we do bestir ourselves, and show ourselves alive to the widest interests of our profession, we may expect to see registration undertaken for us by the Government, and our profession anew put in the bonds of Government red-tape. If we allow this to happen, we may expect for another generation or two to see our profession denied its proper rank as one of the liberal professions.

"The English National Union of Teachers, as we have indicated, represents only one class of teachers in England—the teachers of elementary schools. Yet in its own sphere, and by its almost aggressive vigour, it has shown us an example in many matters. Among these, the work of its Examination Board is worth our study. This Board is under the charge of a permanent paid secretary, whose time is very fully occupied. It has a scheme of local examinations, corresponding somewhat to the Leaving Certificate Examinations of our Scotch Department. It has an excellent scheme of commercial examinations, with certificates, embracing the work prescribed by Chambers of Commerce and such bodies. It has also a scheme of Pupil Teacher Examinations, held quarterly, according to a syllabus which divides up each year's work into instalments, and ensures that pupil teachers shall neglect no part of their course during the year. The ultimate aim of the Union is to get the Board of Education to accept their examinations in place of the Government examination, and thus place the training of young teachers entirely in the hands of their own profession. There is a further scheme that may yet see the light—an examination for a teacher's diploma granted by the N.U.T. itself. This scheme will be much more difficult to realise, but it is precisely what is wanted from a professional point of view.

The E.I.S., with its statutory Board of Examiners, is much more favourably situated for undertaking such work. The E.I.S. has the further advantage of working in a country where the common school teacher enjoys more respect and consideration. Is it too much, then, to expect that the E.I.S. should aim at least as high as the N.U.T., and should claim the right of certifying, or at least of registering, the members of its own profession? Are we to see younger and less favoured bodies go beyond us in this work, and rest content while our chartered professional rights are still unclaimed by us? It is our own fault if we do so. Why should we not claim and enjoy these rights and privileges? We have a legal title to them, and we have no weight of popular opinion to combat in asserting them."

Conclusion. In conclusion, Dr. Gunn admits the Institute has done good work in the past, but it has not yet begun to do the chief work for which it was incorporated. Local associations do good work in educating their members so as to fit them for every new call made on them. Our central authority, however, is too modest; its humility seems to be its most brilliant virtue. Its duty is not merely to advise the Department and to criticise the regulations and Codes of that Department. It must awaken to the fact that this Department is actually attempting most of the work which of right belongs to the Institute. It must claim the rights of every other liberal profession, to regulate the admission of its own members.

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OUR CLASS-ROOM AIDS

OUR EMPIRE SUPPLEMENTS.

1. BRITISH SOUTH AFRICAN COLONIES.

(See Coloured Supplement presented with this Number.)

"Hail! Snatched and bartered oft from hand to hand,
I dream my dream by rock and heath and pine
Of Empire to the northward—ay! one land
From Lion's Head to Line."

SUCH are the words of greeting with which Kipling makes Cape Town greet the mother country. Whether this dream will ever come entirely true, time only can show, but, judging from the march of past events, the near future will witness its fulfilment.

When Diaz, some five hundred years ago, crept down the western coast, feeling continually for an opening eastward by which he could reach the fabulous wealth of the East, he found his way for ever blocked, till a storm, which lasted for thirteen days, drove him farther south than he intended to go, and rounding a rocky headland he reached Algoa Bay. This headland he called the Cape of Storms; but his royal master changed the inauspicious name to the Cape of Good Hope, from the "good hope" he had of reaching India by that route. This hope was fulfilled when, in 1497, Vasco di Gama doubled the Cape, and sailed away across the broad expanse of the Indian Ocean to the land of Prester John. English, Spanish, and Dutch ships soon followed. To the rock-bound land they passed they gave no thought; and even when Jan Antony van Riebek landed on the site of Cape Town in 1652, to found a calling station for the ships of the Dutch East India Company, no European nation dreamed of colonising Africa. Beyond the mountain chains which everywhere bounded the horizon to the landward there lay a vast unknown region, where Bushmen, Hottentots, Kaffirs, Zulus, Basutos, and Matabele roamed undisturbed by the white man. The reedy rivers sheltered the hippopotamus and buffalo; the elephant and the giraffe wandered through the forests; the pathless karroos witnessed the migration of countless herds of antelopes—springbok, gemsbok, eland, gnu, zebra, quagga, kudu; while the lion lay hidden by the water-pool, or in the bushy kloof, to levy tribute on his terrified subjects and afford a feast for the sycophant jackal and snarling hyena.

We took over the Dutch settlements at the Cape in 1795, to prevent their falling into the hands of Napoleon. They were restored in 1802, at the hollow peace of Amiens. We finally captured them, after a slight resistance, in 1806, and the Cape was ceded to us in 1815. The settlements then were limited to the south-west corner of the continent, to

THE SOUTH AFRICAN COLONIES.

Colony.	Area in sq. miles.	Population.	How Obtained.	Productions.	Towns.	Government.
Cape Colony.	280,000.	1,600,000.	1806, Captured.	Grains, wine, tobacco, gold, copper, diamonds, cattle, horses, sheep, elephant, buffalo, springbok.	Cape Town, Grahamstown, Port Elizabeth, Kimberley, East London, Graaf Reinet.	Autonomous. Governor—Sir A. Milner. Council of 23. House of Assembly, 95 members.
Natal.	19,000.	600,000.	1843, Annexed.	Sugar, coffee, indigo, arrow-root, ginger, tobacco, rice, pepper, tea, cereals, sheep, horses, cattle, coal.	Pietermaritzburg, Durban, Ladysmith, Newcastle, Colenso.	Autonomous. Governor. Council of 12. Assembly, 39.
Zululand.	10,500.	700,000.	1897, Annexed.	Mealies and cattle.	Ulundi.	Governor—Sir Walter Hely-Hutchinson. Dependency of Natal.
Basutoland.	10,000.	220,000.	1868, Annexed.	Mealies and cattle.	Maseru.	Crown colony. Commissioner—Sir Godfrey Lagden.
Bechuanaland.	51,000.	80,000.	1885, Annexed.	Mealies, cattle, lead, silver, tin.	Vryburg, Gaberones, Mafeking, Palapye, Tati.	Crown colony. Commissioner—Major Goold Adams.
Rhodesia.	750,000.	500,000.	1889, Charter issued to Company.	Tobacco, rubber, indigo, cotton, mealies and all kinds of grain, cattle, horses, antelopes, gold.	Salisbury, Bulawayo, Umtali, Tuli, Gwando, Gwelo, Victoria.	Administered by Chartered Company. Administrator—W. H. Milton, and Council of 11.
British Central Africa, or Nyassaland.		3,000,000.	1891, Protectorate announced.	Coffee, ivory, rubber, rice, tobacco, cotton, tea.	Blantyre and Zomba.	Eastern part by Commissioner—Alfred Sharpe. Western by British South Africa Company.
Orange River Colony.	48,300.	220,000.	1848, Annexed. 1854, Freed. 1900, Annexed.	Pastoral. Diamonds, garnets, coal, wool, ostrich feathers, hides, and grain.	Bloemfontein, Kroonstadt, Harrismith.	Constitution not yet announced. Probably a modified form of Crown colony, with representatives elected under conditions.
Transvaal.	119,200.	800,000.	1877, Annexed. 1881, Freed. 1900, Annexed.	Pastoral. Cattle, cereals, and gold.	Pretoria, Potchefstroom, Johannesburg, Lydenburg, Rustenburg.	
Walfisch Bay.			1884, Annexed.			

the seaboard between the Roggeveldt and Nieuveldt Mountains and the sea. Some ninety years have passed since then, but what an eventful period! Sometimes by the desire of the home government, more frequently in spite of it; now by legitimate means, and now by means whose legitimacy was, to say the least, doubtful; sometimes checked by bloody wars with Hottentot, Kaffir, Basuto, or Zulu, sometimes advanced by treaty, concession, or purchase; amid hopes and aspirations, perils and dire distress—the boundary line has crept northward and eastward, till, at the present day, the whole country from the mouth of the Orange River to Delagoa Bay, from Cape Town to Lake Tanganyika—an area of a million and a half square miles, with eight to ten million inhabitants—lies under the British flag. Not a bad record for less than a century.

To write the geography and history of South Africa is impossible in a brief article, but the most important events may be noted. From 1811 to 1853 a series of Kaffir wars crippled all development, and it was not till Kaffraria was annexed in 1853 that peace ensued. In 1871 Griqualand East and Basutoland were added to the colony; the Transkei Territory followed in 1879; Griqualand West, with its valuable diamond fields, 1880; Bechuanaland, 1885; Pondoland, 1894; Zululand, 1897.

Smarting under grievances—real and fancied—the Boers in 1835–38 trekked east into Natal, and north-east into the Orange Free State, fighting the Zulus under Dingan in the first place, and the Matabele under Moselekatze in the latter. In 1843 the British Government annexed Natal, and the Boers of that part moved across the Vaal. In 1852, taking advantage of the time when the British troops were fully occupied with the Kaffirs, the Transvaal Boers under Pretorius obtained their independence, and in 1854 the Orange Free State was acknowledged. In 1877, as the Boers could not hold the natives in check, the Transvaal was annexed, only to receive its independence in 1881, after the disastrous Majuba Hill defeat. Recent events are too well known to need repetition.

Of the vast territory to the north little was known. Fifty years ago Livingstone penetrated as far as the Zambesi, and traced its course; but little followed from his exploration, till, in 1889, Mr. Cecil J. Rhodes obtained a charter for the British South Africa Company. In the following year a pioneer expedition under Selous entered Mashonaland and founded Salisbury. This district is undoubtedly the Ophir from which Solomon's ships came once in three years, bringing gold, ivory, apes, and peacocks. The ancient workings, tools, temples, and storehouses are still found. Since then, in spite of the Matabele wars, the disastrous result of the Jameson Raid, plagues of locusts, and the "rinderpest," the Company has pushed ahead. In 1895 it took over the administration of a large part of British Central Africa. Bulawayo is joined to Cape Town by a railway, and the telegraph wire runs to Lake Tanganyika. Mr. Rhodes's project of a Cape to Cairo railway is rapidly becoming an accomplished fact. The line (3 feet 6 inch gauge) will run to the southern end of Tanganyika, through German territory, up the east coast of the lake through Ujiji into British East Africa, and onwards to Fashoda and Khartum.

The whole of British South Africa is not a suitable field for colonists, but out of its vast territory there are many districts capable of supporting a much larger population than at present. The mineral wealth is enormous.

The year 1901 will witness the inauguration of the Federation of Australia; and in a very few years there will be a federated South Africa, in which Cape Colony, Natal, Orange River Colony, the Transvaal, and Rhodesia will be the leading states, and another permanent memorial will be erected to indomitable British pluck and determination.

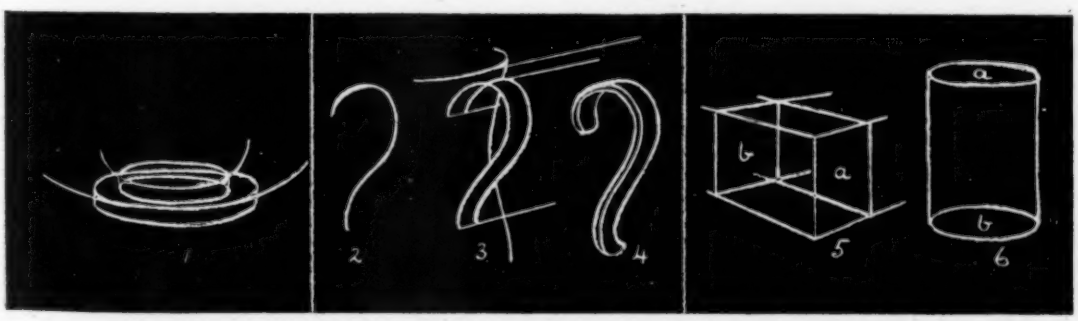
BLACKBOARD DRAWING.

COMMON OBJECTS.

BY EDITH E. BAMFORD, ART TEACHER, EDGE HILL TRAINING COLLEGE.

V.

VARIOUS objects based on the forms of the geometric models should be practised, as suggested in the last paper, the geometric models being sketched first, in order that the perspective may be analysed. For example, a beaker, tumbler, funnel, and inkwell might be sketched, after studying the cylinder and cone; a travelling-trunk and desk, after the square prism. Vases, flasks, etc., may be simplified in form, and the bowl of the vase or flask represented by a circle, ellipse, or oval; for the subtle curves need not, as a rule, be considered. There are difficulties in sketching the *stands* of two objects when one is within the other, as a cup in a saucer, or a jug in a wash-basin. The stand of each object has generally two circles, one above the other; and the bottom circle of the stand of the jug, for instance, is within the top circle of the stand of the basin (Fig. 1). The principles required for the sketching of these stands are explained by the ring; and although it is unnecessary to sketch all the construction lines, the principles should be understood, or the inner object will be sketched as though crushed down or else suspended in air. *Handles* also present difficulties, but unimportant details should be omitted. The following general rules may help, but the shape and perspective of different views necessarily vary. If the handle is to

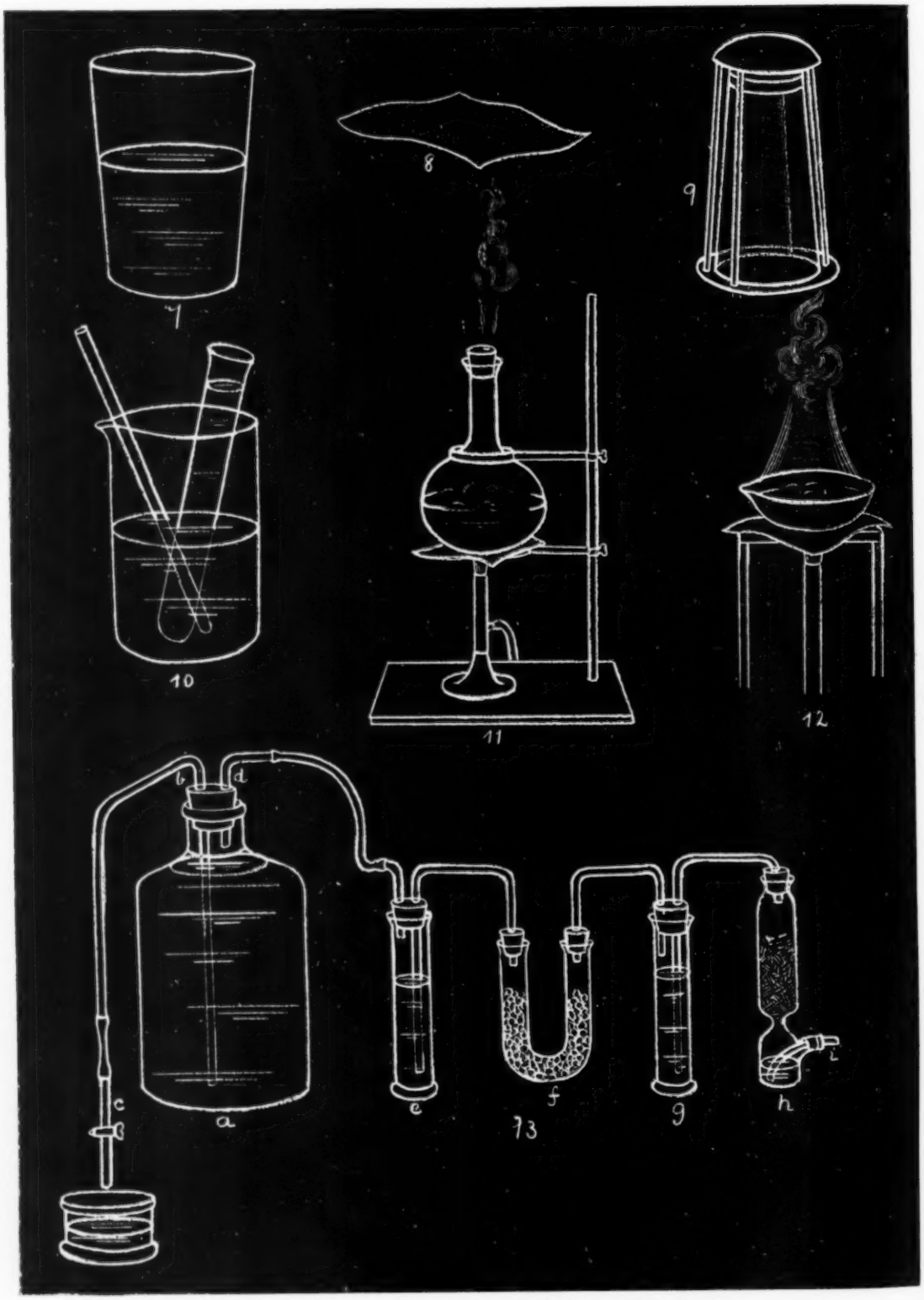


the right of the spectator—(*a*) sketch the form in outline (Fig. 2); (*b*) sketch another similar outline some distance to the right: this should be a little above the first, for the handle will probably have the same general slope as the top of the object to which it is attached (Fig. 3); (*c*) connect these two outlines by means of short lines taking the same general slope as the top of the object, and rub out any part that would be invisible. If the thickness of the handle is to be shown, put another line round the first outline (Fig. 4).

The two following elementary rules of model drawing are very frequently broken when sketching common objects from memory:—

1. When a prism or a cylinder, or any object of similar form, rests upon its side, the back end appears more nearly its true shape than the front end (compare *a* and *b*, Fig 5).

2. When a prism or a cylinder, or any object of similar form, is below the level of the eye, and stands on one of its



BLACKBOARD DRAWING—COMMON OBJECTS.

ends, the lower end appears deeper than the upper (compare *a* and *b*, Fig. 6).

In nearly all sketches, a hard, white line, rather than a soft, gray line, should be produced, so that the drawing stands out clearly; for it must be remembered that much of the effect of a blackboard drawing depends upon the quality of the line.

When sketching science apparatus, water, wire gauze, steam, and transparent objects have frequently to be represented. For still water, a series of horizontal lines, varying in length, should be drawn at irregular distances from each other. These give the effect better than short lines at regular distances—a general way of representing still water. It should be remembered that water takes the same form as the vessel which contains it: and if the surface is visible, it should be outlined the shape of the vessel at that height, and a few horizontal strokes put into the outline (Fig. 7).

Wire gauze, such as is put over a Bunsen flame or round a Davy lamp, can be represented by rubbing the chalk lengthways in an outline, so that a soft, shaded effect is obtained. If the lines of the wire are to be shown, a few cross lines put in the shading will produce the result (Figs. 8 and 9).

Steam can be shown by obtaining a soft, shaded effect first, and then hardening a few curves in the shading (Figs. 11 and 12).

Objects which are put in a transparent liquid and vessel should be represented by a fainter outline after passing into the liquid. Where the object enters the liquid, a long horizontal line, one of a series, may be drawn (Fig. 10).

A sketch of science apparatus used in proving the formation of carbon dioxide by germinating seeds is given. This shows the method of drawing science apparatus arranged as for experiment, when a record of such an experiment is required. *a* represents a bottle filled with water, which serves as an aspirator. Through its two-holed cork pass two tubes—one *b*, which is joined to tube *c*, tube *c* being provided with a glass stopcock; the other *d*, which is in connection with *e*, *f*, *g*, *h*. Cylinders *e* and *g* contain lime-water, and the U-tube germinating seeds. The lower portion of the vessel *h* contains a potash solution, and the upper portion pieces of caustic potash. Air can enter by the tube *i*.

PRACTICAL ELEMENTARY SCIENCE.

AN EXPERIMENTAL COURSE COVERING THE REQUIREMENTS OF BOTH THE DAY AND EVENING SCHOOL CODES IN PHYSICS AND CHEMISTRY.*

BY THOMAS CARTWRIGHT, B.A., B.SC.,

Author of "Practical Chemistry," "'Section One' Physiography," etc.

Solution.—From previous work it is well known that solid substances, when added to liquids, sometimes disappear within the substance of the liquid without increasing the volume of the liquid. This may be shown by filling a wine-glass or other suitable vessel with water quite up to the brim, and by carefully dropping in some powdered salt or sugar. The student should be able to explain why the water does not overflow. Reference in this connection should be made to the earlier work on porosity, which may usefully be here thoroughly revised. The experiment of dissolving a weighed amount of salt in water, and recovering the whole amount by evaporation, should also be cited, and, if necessary, be repeated.

Different Degrees of Solubility.—This should be proved by dissolving in 20 c.c. of water as much powdered salt, sugar, nitre, washing soda, chalk, hearthstone, marble, and other common substances as possible, the powders being well shaken up with the water in order to ensure complete solution. The water is then poured off and evaporated to dryness, and the residues are carefully weighed, the results being arranged in order on squared paper, whereby it will be made clear (*a*) that some solids do, and some solids do not, dissolve in water, and (*b*) that those solids that do dissolve in water do so in very different degrees. It should also be pointed out that, as the water cannot dissolve, at the ordinary temperature, any more of the solids in question, each of the solutions obtained is a **saturated solution.**

Action of Heat.—Each student should be provided with a test-tube, and some nitre should be dissolved in cold water until there is a remainder of nitre which the water cannot dissolve. After drawing special attention to this undissolved residue, the student is directed to boil the water, and to add more of the soda, until at length a saturated hot solution results. Alum, chrome alum, bluestone are other substances which may be used to show that, as a rule, solids are more soluble in hot than in cold water. The teacher should be warned against the use of salt and lime for these experiments, since salt is only slightly more soluble in hot than in cold water, and lime is actually less soluble in hot than in cold water. Of course, these exceptions may themselves be made the subjects of useful exercises.

The Solubility of Gases.—The most striking experiment to demonstrate the solution of gases in liquids is the fountain experiment with ammonia and hydrochloric acid. A flask is filled with dry ammonia, or with dry hydrochloric acid gas. A well-fitting cork provided with a long piece of glass tubing, with one end protruding into the flask and the other immersed in a beaker containing water, the flask being inverted, is the simple apparatus required. The gas creeps down the tube and is absorbed by the water, which gradually creeps up the tube, until at length it arrives at the top, when the gas is absorbed so rapidly as to cause the water to rush into the flask with fountain-like rapidity to take the place of the absorbed gas. If the water is coloured, the effect is made even more striking. The pupils may well perform this experiment in groups; but if a simpler experiment is needed to show the solubility of gases in water, all that is requisite is to fill one or two gas jars with the dry gas, to pour in some water, and, pressing the hand tightly over the top, to shake up for some time. The student should now be required to state what he notices (the sucking down of his hand), and to explain how this has been brought about. To show that there is something in the water after the experiment that was absent from it before, red and blue litmus may be added, first of all, to water (no colour change), and then to the jars in which the ammonia and the hydrochloric acid gas are contained, special note being taken of the change from red to blue in the former, and from blue to red in the latter case. The liquids may also be smelt and tasted, the latter operation being performed by dipping the finger in the liquid, not, of course, by drinking it in the ordinary way. A portion of the liquids should now be transferred to test-tubes, which should be heated until the water boils, a piece of blue litmus paper being held at the mouth of the tube containing the acid, and a piece of red litmus at the mouth of the tube containing the ammonia. What is to be inferred from the change of colour in the papers? It should not be difficult to get the class to see that the heat has caused some of the gas to be driven out of the liquids, and to state that gases are less soluble in hot than in cold water, to which the teacher may add the further statement that this is characteristic of liquids in general, their solvent power for gases generally decreasing as their temperature increases. An interesting corroborative experiment consists of the boiling of water in a flask fitted with a delivery tube that passes under a beehive shelf, placed in a vessel containing water, over the exit hole of which is placed a gas jar filled with water, the flask itself being quite filled with water. A discussion should be started as to the identity of the gas that collects in the gas jar. Can it be water? This question should be seen to be absurd, as, of course, any water gas coming over would at once be converted into liquid by coming into contact with the cold water in the trough. The fact that fishes, which, like ourselves, must breathe air, are able to live in water, should at least suggest the answer—namely, that the gas is air that has been driven out of the water in which it was formerly dissolved, in accordance with the law previously enunciated, that gases are less soluble in hot than in cold liquids.

* Books referred to in this series of articles are published by T. Nelson and Sons

The Solution of Liquids in Liquids.—Vinegar, methylated spirit, and vitriol are good examples of liquids soluble in water in all proportions, as may be shown by actual experiment. The question should arise as to whether or no the vinegar (acetic acid) does not dissolve some of the water, as well as the contrary. All that need be said under this head is to state that the mixture is one of water dissolved in vinegar and of vinegar dissolved in water, and so in all other cases.

No Universal Solvent.—The solvent power of water is so great that it has been called the universal solvent. This is not strictly true, as there are many substances upon which water has no solvent action whatever. To prove this it is only necessary to refer to pebbles, sulphur, iron, copper, and a host of other common substances which may be given to the students to experiment upon, leaving it to their ingenuity to find a way of proving that none of the substance upon which they have experimented has been dissolved by the water (evaporation should occur to all as the simplest method of testing). This will lead naturally to the question as to whether these bodies, insoluble in water, can be dissolved by other liquids. To reply to this query by way of experiment is very easy. A strong test-tube containing a small quantity (about quarter full) of hydrochloric acid should be given to each student. Into this tube is to be placed a small tin-tack or some iron filings, and the student should be called upon to write down in his laboratory book *all* that he observes. (He will probably miss the most potent of all the phenomena presented—namely, the peculiar unpleasant smell that results from the combination of the hydrogen set free by the iron and the carbon present as an impurity in the iron.) The pupil should be instructed to hold his thumb tightly over the mouth of the tube, and to state what happens. He should next be told to apply a light to the mouth of the test-tube upon removing his thumb, and again to record what he notices. Although at this stage it is not necessary that the pupil should know that metals are dissolved by acids with the evolution of hydrogen, he must know that metals, upon which water as a rule exerts no solvent action, are very generally and very easily dissolved by acids. The next step is the evaporation of the liquid, and a study of the residue that remains. Is it iron? It is certainly some new body quite distinct from the iron that was dissolved. This process of solution, wherein a new body is produced, differs very materially from the solution of salt or sugar in water, since evaporation delivers up the same salt or sugar and the same amount of it as was put in. How is the weight affected in the iron experiment? The teacher may either tell, or, better still, show, by weighing the iron and the iron chloride, that in this case there is a gain in weight. Other experiments—such as zinc with sulphuric acid, and copper with nitric acid—may be performed in order to insist upon the fact that **in some cases of solution the body dissolved is recovered by evaporation of the solution, whereas in other cases an entirely new body is found after evaporation.**

Crystallisation.—We have seen that substances held in solution may be recovered by evaporation. Attention is now to be called to another method whereby matter in solution is recovered, and that, too, in a very interesting condition. The teacher should make a hot, nearly saturated solution of one of the following substances—saltpetre, sal ammoniac, alum, chlorate of potash, copper sulphate, potassium dichromate, etc., and should pour out on to a watch-glass, or a piece of window-glass, a small portion of the solution, which should be left to itself for a time, the student watching it, and recording what he sees, and sketching one of the best-formed crystals that he thus sees formed. It is essential that it should be made clear that the same substance crystallises in the same form, and that different substances have different forms. This may be well shown by following the above process with several of the above-named substances. It will be helpful to examine the crystals by the aid of a small magnifying-glass—an ordinary reading-glass will do very nicely. Of course, it must not be expected that every crystal will be perfect; indeed, so close are they together that they must be very imperfect, and a further experiment may be made in order to get perfect crystals and to show how they grow.

How Crystals Grow.—The teacher should make a saturated solution of alum, or, better still, of chrome alum, which should be allowed to crystallise by very slow cooling in a quiet place—the top of the beaker being covered over to exclude dust. When a crop of crystals has formed, a choice should be made of the largest and best formed. Round this should be placed a piece of hair, which should be attached to a piece of glass tubing, from which it should be suspended in the solution of alum for several days, during which it will be found to grow very considerably by adding layers to the outside. This should be very carefully done, as it is not easy to get perfect crystals, and it is very desirable that such should be got. Reference should be made to the crystallisation of minerals in the earth by slow cooling from fusion or from solution, and specimens of these should be shown—rock crystal and Iceland spar being the best and most readily obtained crystalline substances. The diamond will naturally be mentioned, and should, if possible, be also shown.

If further help is required in carrying out the experiments outlined above, it can be got from *Elementary Practical Chemistry*, published by Messrs. Thomas Nelson and Sons.

(End of Stage I.)

BOTANICAL NOTES FOR TEACHERS.

BY PROFESSOR J. R. GREEN, SC.D., F.R.S.,

Late Examiner in Botany to the University of London, and to the University of Cambridge;

AND F. L. GREEN,

Late Science Mistress in the Clifton High School.

Schedule B. 10. *Ground Ivy* (*Nepeta Glechoma*), *Creeping Bugle* (*Ajuga reptans*), *Self-heal* (*Prunella vulgaris*).

The ground ivy is a well-known, pretty flower with creeping stems, kidney-shaped, crenate leaves, and bright, purplish flowers which grow three or four together in the axils of the leaves. It is a strongly aromatic plant with bitter properties, and was formerly used in brewing. In country districts its leaves are sometimes dried and made into tea.

The common bugle grows in woods and moist meadows. The stem is solitary and erect, and has long, creeping runners. The lower leaves are stalked, obovate, obtuse, almost glabrous; the upper leaves are sessile, and tinged with blue. The flowers are blue, in six to ten flowered whorls.

The self-heal is very common in pastures and waste ground. Its whorls of bluish-purple flowers are collected into a cylindrical head which has two kidney-shaped, acuminate, purple-edged bracts beneath each whorl, and a pair of ovate leaves at the base of the head.

These labiate plants can easily be recognised by their square stem, opposite leaves, four-lobed ovary, gynobasic style, stamens didynamous, fewer in number than the lobes of the corolla, and zygomorphic flowers. Evans's *Botany for Beginners*, p. 274, and Snelgrove's *Object Lessons in Botany*, p. 150, take the white dead-nettle (*Lamium album*) as the type of the order. Farmer's *Practical Botany* compares with it the wood sage (*Teucrium Scorodonia*), the wild sage (*Salvia pratensis*), and the gipsywort (*Lycopus Europæus*). Plants of the order used for cooking purposes are mint, pennyroyal, marjoram, thyme, sage, balm.

Schedule B. 10. *Cuttings with tendrils, Cuttings with large stipules, Water Plants with two forms of leaves.*

A tendril is sometimes a modified branch, as in the passion flower and grape vine. In the vine the tendrils are the termination of separate axes. In the passion flower they are thread-like, leafless branches twisted in a spiral direction. On the movements of tendrils, see Farmer's *Practical Botany*, p. 170; and on the tendrils of the passion flower and the vine, p. 23. Tendrils that are modifications of leaves should be studied in the wild clematis, climbing tropæolum, garden pea (*Lathyrus aphaca*). (See Farmer's *Practical Botany*, p. 36.) The tendrils of the cucumber are modified stipules.

Stipules are winged branches of the leaf-blade. They are very large in the garden pea and pansy. In the beech and magnolia

the stipules form the tegmenta, or protective coverings of the buds, and fall off as these open. In the rhubarb they cohere by both inner and outer margins, so as to form a complete sheath which encircles the stem above the insertion of the leaf.

The great spearwort (*Ranunculus Lingua*) is a good example of a water plant with two forms of leaves. The cauline leaves are lanceolate, sessile, six to ten inches long; the earlier submerged leaves are cordate and obtuse.

Ranunculus aquatilis (the water crowfoot) is another good example. (See John's *Flowers of the Field*, p. 14.)

IN NEITHER SCHEDULE. *Potamogeton natans, Potamogeton crispus, Willow Herb.*

The pondweeds are floating, or submerged, plants with perfect flowers in a spike, perianth of four small, green, valvate, persistent leaves; stamens four, carpels four, sessile, free, one-seeded. *P. natans* has two forms of leaves. The flowers are numerous, small, green, arranged in cylindric spikes; carpels keeled, with a short beak. *P. crispus* is common in ditches. It has flowers six to eight in a loose spike; carpels with a long beak.

The willow herbs (*Epilobium*) are showy plants with rose-coloured flowers. They grow in damp places. They belong to Onagrarieæ, herbs with simple exstipulate leaves; sepals four or two, valvate; petals four or two, stamens two to eight; ovary usually four-chambered; fruit a berry or four-chambered capsule. Fuchsias and evening primroses belong to this order.

SCHEDULE A. 6. *Grasses in Variety.*

The natural order Gramineæ comprises about 3,600 species. With the exception of a few plants—for example, the maize and the sugar cane, which have solid stems—the stems of grasses are hollow, and contain much siliceous matter. The leaves are alternate, simple, and usually linear, with no petiole except in a few bamboos, but with a long sheath which embraces the stem. At the junction of the sheath and blade is a small membranous growth, the ligule. The flowers are in spikelets, each consisting of one to five flowers, arranged alternately on a very short axis, the rachilla. At the base of the rachilla two boat-shaped green or purplish glumes, with nothing in their axils, are usually to be found. Within these are the flowers, each with two other glumes—the outer flowering glumes, and the inner, the pale. Within these two glumes, and alternate with them, are the lodicules, minute scales. Each flower has usually three stamens; the ovary is one-chambered and one-ovuled; styles one to three, with feathery stigmas. The caryopsis, or fruit, is entirely filled by the seed, so that their coats adhere, and the embryo lies to one side, at the base of a mass of mealy or farinaceous albumen. The chief cereals belonging to the order are wheat, oats, barley, rye, maize, rice, millets. The chief fodder grasses are rye-grass, cock's-foot grass, Timothy grass, vernal grass, fescues, and tussock grass. Other important economic plants are the sugar cane, bamboos, the esparto grass used in paper-making, and lemon grass, citronella and ginger grass, which are much used in perfumery.

Flowering in September may be found the common cord grass, the black grass, the fine bent, the flote grass, and the rye-brome. The common cord grass is found in muddy, salt marshes in the south. It is a very stiff, erect grass with a long-branched creeping root-stock, and the blades of the leaves jointed to their sheaths. The spikelets are one-flowered, half an inch long, laterally compressed; glumes three, lowest smaller, second five-nerved; flowering glume shorter, awnless; styles long, united half-way up. The black grass has an erect rough stem, leaves with a large blunt ligule, spikelets much compressed laterally, one-flowered, densely crowded into a cylindric spike-like panicle; flowering glume with a slender, bent, dorsal awn. The fine bent (*Agrostis*) is common in pastures. Its numerous small one-flowered spikelets are arranged in an elegant panicle with whorled branches; the outer glumes are boat-shaped, the flowering glume shorter and transparent. The flote grass is a tall perennial grass, common in watery places. The flowers are arranged in a slender panicle, about a foot long, slightly branched; the spikelets are few, linear, adpressed, seven to twenty flowered; the flowering glume three to nine ribbed, subcylindric; the anthers purple, yellowish when empty. The rye-brome has an erect stiff stem; the panicle is slightly branched, loose, and spreading, with a rough flexuous rachis, and branches three to five together; the spikelets oblong, glabrous, five to ten flowered. It is a common grass in corn-fields.

Water Plants.

There are several families of water plants. White and yellow water lilies belong to the natural order Nymphæaceæ; herbs with large orbicular floating leaves; sepals three to six, gradually passing into petals, and these into stamens, both petals and stamens inserted on a fleshy disc surrounding the ovary; ovary many-chambered, many-seeded, with a sessile radiate stigma. Haloragеæ are the mare's-tail family, occurring chiefly in stagnant water.

Plumbagineæ are the thrift family, comprising thrift and sea-lavender, occurring in salt marshes and by the seashore. They have polysymmetric perfect flowers in panicles or heads; calyx inferior, persistent, membranous; corolla five-cleft nearly to the base; stamens five; epipetalous opposite the stamens; ovary of five carpels, one-chambered; styles five; fruit dry, one-seeded. The buckbean, belonging to the gentian family (Gentianeæ), has exceedingly beautiful pink flowers; the leaves are ternate.

Lentibularieæ comprise the bladderworts and the butterworts, both of them carnivorous. The bladderworts are submerged rootless plants with yellow flowers, finely-divided leaves, bearing minute bladders furnished with trap-doors which capture water fleas. The butterworts are small terrestrial plants, with rosettes of radical leaves with inrolled margins and viscid glandular surfaces which capture small flies.

The shoreweed (Plantagineæ) forms a matted turf under water. Its leaves are all radical, linear, fleshy, flat above and curved beneath, and nearly glabrous. The solitary staminate flowers have the parts in fours; there are two or three carpellate flowers sessile among the leaves; the ovary is one-chambered. The sea beet (Chenopodiaceæ) is frequent on seashores. It is a tall succulent plant with angular striped stem, large-stalked ovoid fleshy leaves, and numerous long slender leafy spikes of green flowers, which are arranged two or three together, with a small lanceolate leafy bract at the base of each. The great water dock (Polygonaceæ) grows on river banks. It has a stem three to six feet high, lanceolate leaves, often more than a foot long, and green flowers in crowded whorls, forming very large, almost leafless panicles; the inner perianth-segments are triangular, netted with oblong tubercles.

The rush family (Juncaceæ) are marsh plants with cylindric or flat leaves, a membranous perianth, stamens six, rarely three, with introrse anthers; ovary one to three chambered, many-ovuled; stigmas three, wind pollinated; fruit a capsule.

The reed-maces (Typhaceæ) include the bulrush or cat's-tail and the bur-reeds. The former grows six to eight feet high, and has a club-like spike of pistillate flowers which is continuous with that of staminate flowers. The latter are graceful aquatics with sword-shaped leaves, and flowers in distinct, dense, globular heads; perianth three to six leaved, membranous; stamens two to three, distinct.

Lemnaceæ, the duckweed family, consist of minute green plants floating in standing waters. They are composed of leaf-like scales with no distinction of stem and leaf. Generally they have unbranched, thread-like roots hanging downwards in the water, propagating themselves principally by offsets, but sometimes producing one to three minute flowers, which are monœcious, and generally enclosed in a small membranous spathe; staminate flowers each of a single stamen; carpellate flower; a one-chambered, one to seven ovuled ovary; fruit bladdery, indehiscent.

The water plantain family (Alismaceæ) includes water plantains, arrow-head, and the flowering rush. The handsome flowers of the flowering rush are rose-coloured, an inch across, and arranged in an umbel; stamens nine, with red anthers; carpels six.

The Naiadaceæ (pondweed family) comprise arrow-grass and pondweeds. Their leaves are sheathing at the base, the flowers small, in conspicuous olive green, stamens one to six, hypogynous, carpels one to six, indehiscent, one-ovuled.

The sedge family (Cyperaceæ) is a large order of plants which differ in structure from the grasses in their solid angular stems with unswollen nodes, their tristichous leaves with unsplit tubular sheaths, their basifixed anthers and less feathery stigmas. It contains the bulrush and the African papyrus.

OUR ILLUSTRATED GEOGRAPHICAL NOTEBOOK.

RUSSIAN NOTES.

A New Ship Canal.—The importance of canal systems to commerce now needs no demonstration. Over a hundred years ago the Düna and the Dnieper were connected by means of canals and the tributary Berezina. The produce of the surrounding provinces was thus conveyed to the

Baltic Sea *viâ* Riga, until the introduction of railways caused the decay of the canals. A project is now afoot for providing a depth of eighteen feet of water from sea to sea. This would allow the passage of quite large foreign vessels, and would make important ports in the very heart of Russia. It is calculated that the cost of construction, dredging, etc., would amount to £24,000,000. It is thought that even a depth of four or five feet would render the undertaking profitable. In any case, the matter is of great importance to industrial Russia.

The mouth of the Dnieper is already being deepened to twenty-two feet, to allow vessels to ascend to Kherson. Hitherto grain has gone to Odessa in barges, there to be transhipped.

The Great Siberian Railway.—The Trans-Siberian Railway shows little prospect of conferring those untold advantages on Russia which were so confidently anticipated. From Lake Baikal eastwards the line is badly constructed, and much of it will probably have to be relaid, for the track is poorly ballasted, the sleepers are of unsuitable wood, and the rails are only about half the weight that is necessary for heavy traffic. Sharp curves, steep gradients, narrow embankments, and unprotected cuttings all bear witness to the

cheapness and rapidity which have marked the operations from the commencement.

An eminent English engineer calculates that the line cannot be completed for nearly five years, and another £20,000,000 will be absorbed to place the line in a really good workable condition. Even this estimate does not take into consideration the probable delays that the Chinese trouble will inevitably cause in the Manchurian section.

It was popularly supposed that the completion of the railway would cause a radical change in the balance of power in the Far East, and that its strategic advantages would at least yield to Russia the complete domination of the Pacific coast. This last, however, does not seem to be an asset that Russia will be able to set against the enormous expenditure the line has already involved. A Russian army on the Pacific coast could not be fed from Siberia; and if Britain and Japan were hostile, its base must necessarily be in Europe. To convey provisions with regularity over such enormous distances of ill-constructed single-track railway would be impossible.

The President of the Institution of Mining and Metallurgy has recently travelled over the entire route. "I left Shanghai for London on the 12th May, and travelled by steamer to Vladivostock, and thence to Moscow *viâ* the Amur River and the Siberian Railway. The journey from Shanghai to London by this route occupied fifty-one days, and through Siberia was slow, monotonous, and uncomfortable to the last degree.....The Siberian route, as a means of communication with the Far East, is quite impracticable; it will be a precarious and uncomfortable journey for many years to come."

It is very evident that Britain will still remain stronger in the Far East than Russia. We can draw an immense army from India, and our incomparable service of transport vessels would ensure its maintenance in comparative comfort.

The Great Siberian Railway will be of value in opening up the mineral wealth of Siberia, and in promoting trade between Russia and China. Disappointment seems to lie beyond this.

New Openings for Trade.—The Siberian gold-fields and petroleum have occupied the attention of British capitalists to the exclusion of other promising fields of industry. M. Kovaleffsky, the director of the department of trade and manufactures in the Russian Ministry of Finance, has, however, drawn attention to two natural resources which are only awaiting capital and energy to yield far more profit than gold-mines.

As in Canada, the forest wealth of Russia is almost unbounded, and timber is the fourth export in value. But Russia is unlike Canada in that she does not possess carpentry and joinery mills on any extensive scale, and exports nothing but the raw material. There is no reason why Russia should not manufacture doors, window-frames, etc.; and wood pulp, too, could readily be made. It is worthy of note that Scandinavia and Finland have already embarked in this business, and Russia will shortly follow suit.

Manganese iron, or tinplate iron, is imported into Russia very largely, notwithstanding the raw material is found in abundance in South Russia and the Caucasus. Much of it is exported to England. The production of the finished material on the spot offers such indubitable advantages that the matter of its manufacture will not be allowed to remain much longer in abeyance. Perhaps too often we view Russia simply as an obstacle and hindrance to our policy in the Far East, whilst nearer home the vast empire possesses natural advantages in which we may to some extent share.

Doubtful Advantages of Protection.—Materials for Russian railways must be purchased within the empire, unless very good reasons for the contrary can be adduced. The Russian railway works have not been slow to take advantage of this, and have charged exorbitant prices for indifferent material. The railway companies and contractors are beginning to see that they pay dearly for this phase of patriotism, but are still powerless to purchase to advantage abroad unless they obtain permission from the Minister.

Eggs.—In 1871 Russia exported 142,000,000 eggs; in 1888, 684,000,000; and last year, 1,831,000,000. The United Kingdom takes nearly £1,000,000 worth of these, at an average price of a little more than sevenpence per dozen. The egg business is one that the British farmer does not sufficiently study, for the greater portion of the money, if not the whole of it, might very well be kept at home if poultry farming were taken up on proper lines.

ELEMENTARY LESSONS IN THE PRINCIPLES OF GRAMMAR.

A Course of Forty Oral Lessons for the First Year (New Code, Standard IV.).

BY JOHN R. TIMSON, B.A.

LESSON XXXII.

EXPLANATORY PARSING.

PRACTICE in rapid parsing is a most valuable exercise, because we are compelled to think at every step before we speak. But the practice must not become mechanical by reproducing words in a certain order without thinking of the meaning. This would be to speak like a parrot.

We ought not, however, to have to stop to call to mind what point should be considered next. For parsing a verb we must commit to memory "kind, formation, mood, time, state of action, tense, number, person agreeing with," and then we may devote all our thought to the meaning of the words, to discovering and stating their classes.

To avoid becoming mechanical it is a useful exercise to give reasons for every statement.

Tom runs.

Tom.....*Proper noun*, because it is the person's *own* name.
Masculine gender, because it names a person of the male sex.
Singular number, because it denotes *one* person.
Third person, because it names a boy who is neither speaker nor hearer.
Nominative case, because it is used to name the subject of the assertion "runs."

Runs.....*Intransitive*, because it indicates action ending with the subject and not passing to an object.
Verb, because it indicates the assertion of the speaker, and means in full, "I say 'runs' about Tom."
Irregular, because it does not form its past tense in "d" or "ed"; "ran" is the past tense.
Indicative mood, because it indicates a fact.
Present tense, because it indicates time now.
Singular number, because the subject "Tom" is singular.
Third person, because "Tom" is third person.
Agreeing with "Tom," because a verb is like its subject in number and person.

The subject is that about which a speaker makes an assertion.

Making an assertion is declaring or stating something about a subject. The full assertion is called the predicate.

The man is a beggar.

"Man" is a word used as a *mark* or *name* to denote a male adult.

"Beggar" is a word used as a *mark* or *name* to denote one who begs.

"Is" is a word used as the *mark* of the speaker's assertion, "I say or I assert" the man to be one who begs.

The subject may be denoted by—

1. A pronoun. *He* came.
2. A noun. The *boy* works.
3. A present participle used as a noun. *Playing* is pleasant.
4. A verb in the infinitive mood. *To play* is pleasant.

An object may be denoted in the same way—

I told *him*. He struck the *dog*.
We like *skating*. I like *to sing*.

The infinitive mood requires the verb asserted of it to be singular number, third person, as it denotes a single action spoken about.

For the present these are the only forms we will use for subject and object.

Adjectives sometimes stand alone as subject or object, but at this stage they may be parsed as qualifying a noun understood; for example,—

The brave are good.

Brave...Adjective, qualifying "persons" understood.
Are.....Plural number, third person, agreeing with "persons" understood.

MEMORY NOTES.

To run is enjoyable.

To run.....Intransitive verb, irregular, infinitive mood denoting the subject, singular number, third person, nominative case to "is."
Is.....Verb "to be," irregular, indicative mood, present tense, singular number, third person, agreeing with "to run."
Enjoyable...Adjective, qualifying "to run."

The infinitive mood is the verb used as a noun.

The infinitive mood may be—

1. Present tense.....To run.
2. Imperfect tense.....To be running.
3. Perfect tense.....To have run.
4. Perfect progressive tense...To have been running.

These four forms may be used as subjects of an assertion, and are always singular number, third person, with which the asserting verb must agree. They may also indicate objects.

LESSON XXXIII.

ANOMALOUS VERBS WITH THE INFINITIVE MOOD.

We have noted that the mood or disposition of the speaker in making an assertion is shown by the mood of the verb:—

Certainty, by the indicative mood.
Doubt, by the subjunctive mood.
Command, by the imperative mood.
Regard of the action without a subject, by the infinitive mood.

Other dispositions or moods are expressed by distinct verbs, with a verb in the infinitive for object. In many of these cases "to" is omitted in the infinitive mood.

1. *Determination or Purpose.*

I will go.

This means, "I am *determined to go*." "Go" is the infinitive mood, the action being the object of the speaker's *will*.

In the second and third person "shall" is used instead of "will." This verb implies obligation.

Thou shalt, he shall.
You shall, they shall.

"Thou *shalt* go" means, "It is thy duty *to go*."

Shalt...Transitive verb, irregular, indicative mood, present tense, singular number, second person, agreeing with "thou."
Go.....Irregular verb, intransitive, infinitive mood naming the object, singular number, third person, objective case, governed by "shalt."

Let us remember that "shall" in the first person and "will" in the second and third persons denote future tense. The reverse holds when they are principal verbs.

2. *Permission.* May.

Present—You may sing.

May...Transitive verb.
(To) sing...Infinitive mood, object permitted.

3. *Power.* Can, could.

Tom *can* run—that is, Tom *is able* to run.

Can...Transitive verb.
Run...Infinitive mood, object, governed by "can."

4. *Duty.*

He ought to come.

Ought.....Transitive verb.
To come...Object, governed by "ought."

5. *Boldness.*

I *dare* fight.

6. *Necessity.*

They *must* work.

These verbs are all words or assertions of the speaker. There is really nothing contrary to rule or "anomalous" about them, except in their conjugation.

The verb "let" is used to mark *permission*. It has two objects: one is the person to whom permission is granted, the other object is that which is granted; for example,—

He let me play.

Me.....Objective case, governed by the transitive verb "let."
(To) play...Infinitive mood, object, governed by "let."

The person as object is called the indirect object. Similar cases are the verbs of giving and teaching: for example,—

He taught *me geography*.
You gave *him sixpence*.

We shall more closely examine the indirect object in our next course.

The imperative mood of "let" should be remembered.

Let me go = (thou) let me to go.

(To) go...Object of "let"—the object permitted.
Me...Object of "let"—the person for whom permission is asked, called the indirect object.

Similar verbs, such as bid, need, wish, please, hope, desire, long, fear, want, love, express feelings or moods, and take verbs in the infinitive mood for objects.

Examples should be practised with them.

MEMORY NOTES.

Many verbs which are used to assert moods of the speaker, or of a subject, take verbs in the infinitive mood for objects, often without "to."

ASSERTIONS OF	SUBJECT.	PREDICATE.	OBJECT.
1. Determination	I	will	go.
2. Permission.....	Tom	may	play.
3. Power.....	He	can	jump.
4. Duty	We	ought	to go.
5. Boldness	The boys	dare	fight.
6. Necessity	Men	must	work.

NATURE LESSONS FOR INFANTS.

HOW ANIMALS AND PLANTS PROTECT THEMSELVES.

Preparation.—Coloured pictures of the Arctic Regions, a Desert, and of a Forest will be needed.

If the children are very young, it will be necessary to take one lesson for each section, and to show pictures of the special animals mentioned.

A visit to the Natural History Museum, South Kensington, would be found very helpful, as many animals are there arranged in surroundings as nearly natural as possible, and protective colouring is thus beautifully shown.

INTRODUCTION TO SERIES.

Why do animals need to protect themselves? Even men and women have enemies against which they have to be protected. In some countries these enemies are fierce, wild animals against which men have to arm themselves with guns and other weapons

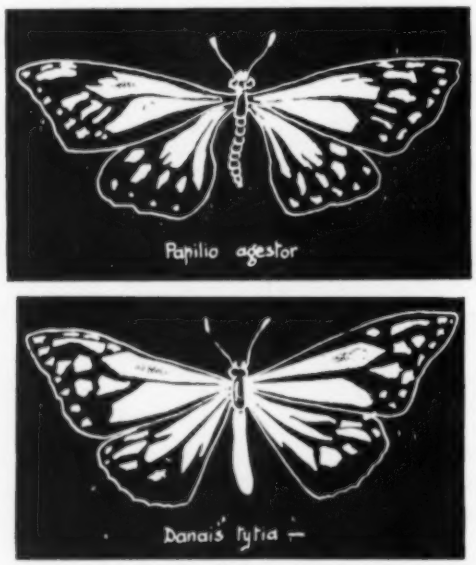


Fig. 1.

of defence. In our own country there are no such large wild animals, but we sometimes have to be defended from *people* who might do us harm. Our policemen help to protect us at home, the sailors in our navy protect us from enemies at sea, and the soldiers protect us from enemies abroad.

Most *animals* have many enemies, against which they protect themselves in very wonderful ways. The chief of these are: by using various weapons of defence with which they are provided; and by trying to hide from their enemies, either by looking so like their surroundings that they cannot easily be seen, or by making special hiding-places for themselves.

Plants have enemies as well as animals; but they cannot run away and hide, so they chiefly depend on weapons of various kinds.

I.—PROTECTIVE COLOURING IN ANIMALS.

If animals can succeed in hiding from their enemies, they are, of course, quite safe; but if they had to be always in some hiding-place, they would have no pleasure in life—wild animals could not roam about the forests, nor birds fly in the woods. Even if they did not wish to leave their hiding-places, animals would be obliged to do so in search of food. Fortunately, animals are to a great extent protected by their colouring, which in many cases is so like their surroundings that it serves to conceal them, so that they may go about as they wish, and yet feel comparatively safe from their foes.

Talk to the children about the war, where the officers used to dress more finely than the men, and so could easily be seen; and help them to see why it had to be given up because of the unnecessary danger to which it exposed them.

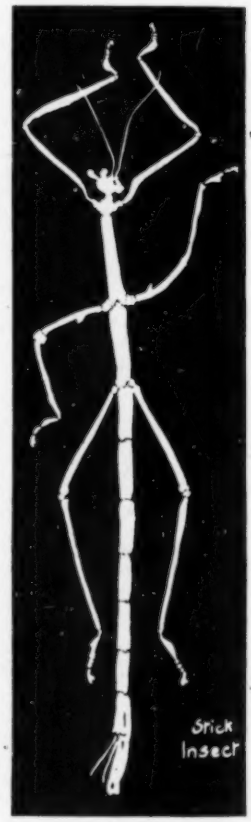


Fig. 2.

Arctic Animals.—Show a picture of some arctic region, and help the children to imagine its appearance, with ice and snow everywhere. Draw from the class how easily dark-coloured animals could be seen, and ask what would be the safest colour for them.

The polar bear, the snowy owl, the polar hare, and the Greenland falcon are all perfectly white, and live in regions where snow is on the ground nearly all the year.

In some parts the snow lies on the ground for about half the year only; therefore many of the animals change from brown to white, according to the season, as the white colour would be just as noticeable in the summer as the brown would be in the winter. Among these animals are the arctic fox, the stoat, the arctic hare, and the ptarmigan.

Desert Animals.—Describe a desert, picturing its vast stretches of sand, with no trees or shrubs—indeed, with nothing which would serve as a hiding-place.

The lion, the camel, the desert antelopes are all sand-colour. The upper plumage of every desert bird, the fur of all the smaller mammals, and the skin of all the snakes and lizards, are of the same sandy colour as the desert in which they live.

Forest Birds.—Ask children to tell the name and colour of any bird they know. In this way they will see that the ground-colour of most of our English birds is brown. The reason for this brownish colouring can be found by the children by thinking of the bark, withered leaves, and brown earth among which the birds live; for it is only for a very short time that green is a more prominent colour even in woods and forests.

Fig. 3.

In tropical forests there are dense masses of evergreen foliage among which birds have to hide; so we find here just what we

should expect—whole groups of birds whose chief colouring is green.

Sea Animals.—Many animals which live in the sea—for example, the jelly-fish—are so transparent that they are almost

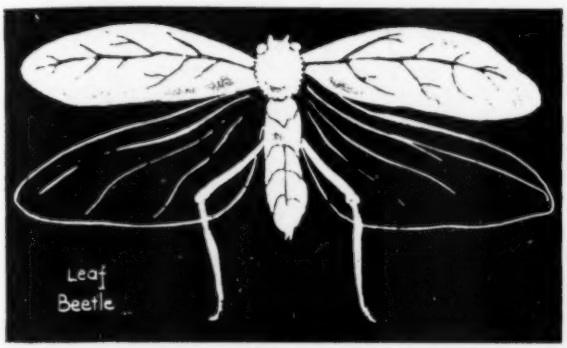


FIG. 4.

invisible when floating in the water. Animals which live on sandy shores are generally sand-colour on one side. Soles and plaice and many other fish are sand-colour on one side, while the other side, which cannot generally be seen, is white. If seen from below, the fish resembles the sky.

Insects.—Insects have many enemies, and the worst of these are birds. Many birds live entirely on insects. One of the most successful ways in which insects seek to escape from their enemies is by *mimicry*. Some perfectly eatable insects so closely resemble certain uneatable ones that birds will not touch them. For instance, the two butterflies shown in Fig. 1, which look wonderfully alike in marking and colour, really belong to quite distinct groups. One of them gives out an unpleasant yellow juice which is most offensive to birds; while the other would be quickly eaten by them, if they did not mistake it for a member of the uneatable group, because it has imitated their marking and colouring so exactly.

Some insects look just like *pieces of stick*, with knots and branches, and they have to be touched before one can be sure they are living creatures. (Fig. 2.)

The *leaf insect*, too, is so like the leaves of the food-plant on which it lives that it needs very sharp eyes to find it; even its legs are leaf-like in colouring and shape. (Fig. 3.)

The wing-cases of the beetle in Fig. 4 are bright-green and yellow, and are veined to look like leaves, while its legs are brown and twig-like.

Many butterflies resemble dead leaves on the outer sides of their folded wings. They settle on some withered foliage, and in shape, colour, and attitude are perfect imitations of it. Each

FIG. 5.

butterfly settles on a twig, with the short tail of the lower wing touching it, to look like a stalk. From this stalk a dark line runs to the tip of the upper wings, imitating the midrib of the leaf. (Fig. 5.)

There are many other animals which have protective colouring besides those already mentioned: for example, nocturnal animals—such as mice, rats, and bats—are dusky colour; tigers have striped bodies, which enable them to hide among the long grass where they live. But it would take pages only to name examples; and the above will illustrate the theory that adaptive colouring is one of the best means of protection from their enemies possessed by animals.

Circular 449.
A.

BOARD OF EDUCATION, SOUTH KENSINGTON, LONDON, S.W.

SIR,—I am directed by the Board of Education to inform you that, after the examinations of the present year, the following regulations affecting drawing in training colleges will come into force:—

There will be alternative courses of instruction in drawing, each of which is intended to cover two years' study at the training college. But a college may not, as a rule, take the two courses concurrently.

Students who obtain the necessary successes will be granted either the Elementary Drawing Certificate, or the Training College Drawing Certificate, according to the course of instruction adopted.

All students must be instructed in drawing with chalk on the blackboard (see Syllabus for Drawing on the Blackboard), and must be presented, in each of the two years, for examination in that subject. Success in that subject is required for the grant of either of the above-named drawing certificates.

In the course for the Elementary Drawing Certificate, instruction must be given in respect of freehand drawing of ornament in outline, model drawing, drawing in light and shade from the cast, geometrical drawing (art), and perspective (see the Syllabuses for those subjects).

In the course for the Training College Drawing Certificate, instruction must be given in geometrical drawing (art) and perspective, and in drawing from common objects, casts of ornament, or flat examples in pen, pencil, chalk, or brush. The drawings may be in outline, or they may be shaded. If shaded by the brush, the tints must be in monochrome.

The Elementary Drawing Certificate will be granted to a student who passes in blackboard drawing, already mentioned, and obtains second classes in either freehand drawing of ornament in outline, or in model drawing; in drawing in light and shade from a cast; in geometrical drawing (art); and in perspective. Successes obtained under old rules will be accepted as far as possible in lieu of the new requirements for this certificate.

The Training College Certificate, which is a newly-instituted form of certificate, will be granted to a student who passes in blackboard drawing, already mentioned, and obtains second classes in geometrical drawing (art), and in perspective, and the mark Good or Fair for drawings submitted for examination. Such drawings must be submitted to the Board for examination on the 1st of April in each year, in accordance with regulations similar to those in Form 564.

Well-finished drawings only should be submitted for examination; and if work in colours be submitted, it must be clearly understood that it will be examined according to the standard adopted for painting from still life, from casts, from common objects, and for design in colour.—I am, your obedient servant,

W. DE W. ABNEY.

The Principal, Training College,

.....

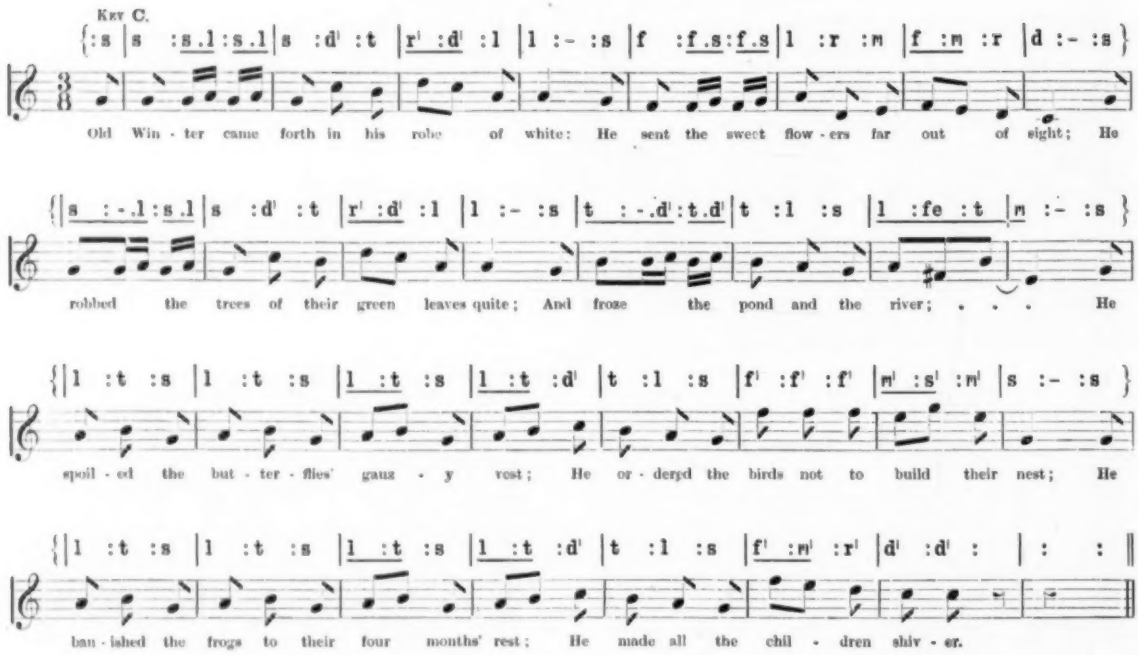
Next Month:

PHOTOGRAPHIC COMPETITION AWARDS

and

FRENCH AND GERMAN PRIZE COMPETITIONS

as usual.

OLD WINTER CAME FORTH.

Key C.
Old Win - ter came forth in his robe of white: He sent the sweet flow - ers far out of sight; He
robbed the trees of their green leaves quite; And froze the pond and the river; . . . He
spoil - ed the but - ter - flies' gauz - y vest; He or - dered the birds not to build their nest; He
ban - ished the frogs to their four months' rest; He made all the chil - dren shiv - er.

Old Winter came forth in his robe of white:
He sent the sweet flowers far out of sight;
He robbed the trees of their green leaves quite;
And froze the pond and the river;
He spoiled the butterflies' gauzy vest;
He ordered the birds not to build their nest;
He banished the frogs to their four months' rest;
He made all the children shiver.

Yet he did some good with his icy tread:
For he kept the corn-seeds warm in their bed;
He dried up the damp which the rain had spread;
And he rendered the air more healthy.
He taught the boys to slide; and he flung
Rich Christmas gifts o'er the old and young;
And when cries for food from the poor were wrung,
He opened the purse of the wealthy.

We like the Spring, with its fine fresh air;
We like the Summer, with flowers so fair;
We like the Autumn, with colours so rare;
And we like, too, old Winter's greeting.
His touch is cold, but his heart is warm;
So, though he may bring to us wind and storm,
We look with a smile on his well-known form,
And ours is a gladsome greeting.

OUR TUTORIAL SECTION

OUR PUPIL TEACHERS' AND SCHOLARSHIP COURSE.

BY ARTHUR T. FLUX,

Principal of the Belvedere Pupil Teachers' Centre, First on Scholarship List, Author of "Scholarship School Management," "Building of the British Empire," etc.

SPRING EXAMINATION, 1901.

Fifth Month—September.

WORK TO BE PREPARED.

1. READING AND RECITATION.

TEN minutes' practice per diem, with due attention to emphasis, modulation, clear enunciation, and pronunciation.

2. ENGLISH.

Candidates.—*Marmion*, Canto vi., lines 444–568.
First Year.—*The Traveller*, lines 190–238, with twenty roots and meanings each week, or the derivation of all important words.
Second Year.—*Julius Cæsar*, Act iii., Scene 1.

(For full Notes on Paraphrasing, Parsing, Analysis, etc., see September Number, 1899.)

Note.—Although the parsing and analysis will take up much time, the student must not confine his attention to these points alone. One or two questions are usually set on the grammar, and a collection should be made from the poem of illustrative examples of the more difficult points—for example, uses of the infinitive, nominative absolute, subjunctive mood, etc. The etymology must also be studied, candidates preparing thoroughly all affixes—first year pupil teachers all prefixes and important derivations, and second year pupil teachers the preceding, and also the peculiarities to be found in *Julius Cæsar*. The latter are given at length in Moffatt's edition of the play. Figures of speech must be learned by all years, with examples from the poem of their use. The different poems must be studied as *literature*, and not merely as parsing exercises.

Composition.

Write one or two essays each week, selecting from the following:—*The Telescope; Fruit Trees; Habits of Domestic Animals; The Force of Example; Your Favourite Book; The Changes of Fortune.*

Give plenty of time and thought to this exercise; too much can hardly be given. Study the common mistakes in *Pupil Teacher's English Notebook*, and take care to avoid them.

3. HISTORY.

Candidates.—Henry IV. to Richard III.
First Year.—Edward III. to Richard II.
Second Year.—James II.

Notes.

Candidates.—The following points must be clearly understood:—

1. Henry's title. He was not the nearest heir, but he was not on that account a usurper. There was no law by which the nearest heir succeeded, although it was usual. The Parliament elected him as king.
2. Henry owed his position—
   (*a*) To the support of the church; *therefore* he had to please them. Hence the passing of the Statute De Heretico Comburendo.
   (*b*) To the support of Parliament; *therefore* he had to yield to the demands of that body, and the Lancastrian period is noted for the advances made in the privileges of the Commons. They secured freedom of speech, redress of grievances before granting supplies, the right to control the public accounts, the sole privilege of introducing or altering money grants.
   (*c*) To the nobles; hence their lack of loyalty and the risings against him—
      (1) In 1400, Earls of Huntingdon and Kent.
      (2) 1400–1410, Owen Glendower and the Percies.
      (3) 1407, Northumberland, Nottingham, and Archbishop Scrope.
      (4) 1408, Northumberland.

Henry V. diverted the barons' attention from their own jealousies and quarrels by directing them against a common enemy—France. The French campaign must be thoroughly prepared.

Henry VI. is an illustration of what is often met with in history—a weak son following an able father.

The long minority and the squabbles among the leading barons, the loss of the French provinces, the heavy taxation, the character of his wife, all prejudiced the people against him, and led to the popularity of the Yorkist cause.

A genealogical table must be carefully prepared showing the descent of the Lancaster and Yorkist kings and the Beauforts.

The course of the wars; the results (decay of the Feudal System, etc.); Warwick the King-maker; Edward IV., the brilliant and energetic soldier, but a vicious and indolent king; the ability of Richard III., are points which must be carefully studied.

First Year.—See Notes for Candidates last month.

The Peasants' Revolt should be made the hinge on which to hang a concise knowledge of the social life of the working-classes since the Conquest. Reduced by the Norman supremacy to a state of serfdom, they had for centuries been regarded as little better, if indeed as good, as the cattle of their owners. They lived in miserable huts, on the plainest fare, and were clad in the commonest clothes. They laboured from sunrise to sunset, generally on the lords' lands, and sometimes on the strips of land allotted to them for their own use, where they grew enough corn, beans, and vegetables to keep them alive. Education, pleasures, aspirations and ambition they had none. If they did succeed in producing more than was needed for their own consumption, and took this produce to market, the dues to be paid swallowed up all profits. From this state of suppression a variety of causes tended to emancipate them. The wars in France caused the manumission of many, and at the same time opened their eyes to their condition. The Black Death, by reducing the supply of labour, led to an endeavour to profit by it by the securing of higher wages—a movement which the Statute of Labourers failed to suppress. Wycliffe's "poor preachers" added to his scheme of gospel teaching a propaganda of socialism on their own account, which they zealously taught wherever they went. The loss of the French possessions, and the heavy taxes imposed upon the labouring classes, raised their discontent to the verge of insurrection, and the methods of the tax-gatherers led to the actual outbreak. Tyler was connected with it by a mere accident. Their grievances are shown by their demands—(1) the abolition of villenage, which was practically obtained; (2) the abolition of market tolls; and (3) rent of land to be fixed at fourpence an acre. The last was not very fair in the amount quoted, but it inaugurated the system of letting land on a money rental instead of personal service.

Second Year.—James II. Chief points:—

1. Rebellions (*a*) of Argyll and (*b*) Monmouth—the latter followed by the Bloody Assize.
2. Attempts of the king to rule by means of unjust judges and a standing army.
3. Declaration of Indulgence, 1687; renewed, 1688.
4. Subsequent arrest, trial, and acquittal of the bishops.
5. Invitation to William of Orange; landing of William; flight of James.
6. The Convention Parliament and the Declaration of Rights, which settled the points at issue between King and Parliament by limiting exactly the position and power of each.

4. Geography.

Candidates.—The remaining counties of England.

First Year.—Finish Europe.

Second Year.—Physical features, climate, and productions of North America.

Use maps for every detail to be learned. Analyse text-book and tabulate in notebook, and then commit to memory.

5. Arithmetic.

Candidates.—Addition, subtraction, multiplication, and division of decimals; their conversion to vulgar fractions, and *vice versâ*.

Prepare the theory thoroughly. The rules governing the results of converting vulgar fractions to decimals must also be noted. Which fractions produce finite decimals, and why? Learn the following rule: "When the denominator of a fraction in its lowest terms contains no other factor than 2's and 5's, it may be represented as a finite decimal."

First Year.—Simple interest.

These sums must be worked by method of unity, or by the fractional method, and *not* by formula.

Second Year.—Stocks and shares. Thoroughly master the terms employed, and distinguish carefully between *stock* and *money*.

6. Euclid and Algebra.

First Year.—Props. 13–16, and four deductions per week.

Elementary factors and their use.

Second Year.—Props. 43–48, and four deductions per week.

Fractions generally.

A great deal depends upon a thorough grip of algebraic factors. If this is not obtained, future work is increased tenfold.

The following factors are the A B C of the subject:—

$(a + b)(a - b) = a^2 - b^2$.
$(a + b)^2 = a^2 + 2ab + b^2$.
$(a - b)^2 = a^2 - 2ab + b^2$.
$(a + b)^3 = a^3 + 3a^2b + 3ab^2 + b^3$.
$(a - b)^3 = a^3 - 3a^2b + 3ab^2 - b^3$.
$(a + b)(a^2 - ab + b^2) = a^3 + b^3$.
$(a - b)(a^2 + ab + b^2) = a^3 - b^3$.

These must be thoroughly learned and understood, so as to apply them in any case with any letters.

Knowledge how to factor a trinomial is also most useful.

The following are the four typical cases where there is no coefficient to x^2:—

1. $x^2 + 5x + 6 = (x + 2)(x + 3)$.

Find two numbers which, multiplied together, give the third term, and, added, give the second. Both signs +.

2. $x^2 - 5x + 6 = (x - 2)(x - 3)$.

As above, *but* both signs −.

3. $x^2 - x - 6 = (x - 3)(x + 2)$.
4. $x^2 + x - 6 = (x + 3)(x - 2)$.

Find two numbers which, multiplied, give the third term, and, subtracted, give the second. The sign of the greater is the same as the sign of the middle term.

Text-book will give exercises and fuller explanation.

7. Music.

General revision and working of back questions.

Test Questions.

1. *Penmanship.*
   Large Hand:—*The Philippine Islands.*
   Small Hand:—*Genius is the capacity for taking infinite pains.*
2. *English.—Candidates.*
   (*a*) Analyse lines 374–379.
   (*b*) Parse *must, no longer, foul fall him, first.*

First Year.
   (*a*) Paraphrase and analyse lines 175–185.
   (*b*) Parse *still, even, though, rear, deal, each wish contracting.*

Second Year.
   (*a*) Paraphrase and analyse—
   "Cowards die.....will come."
   (*b*) Parse *many times, but once, it seems, strange, seeing that, end.*
3. *History.—Candidates.*
   (*a*) Give some account of the later years of Edward the Third's reign.
   (*b*) Give the causes and results of the Peasants' Revolt.

First Year.
   (*a*) Say what you can of the conquest of Wales.
   (*b*) Mention the chief legal measures passed in the reign of Edward the First.

Second Year.
   (*a*) What was the Clarendon Code?
   (*b*) What was the Habeas Corpus Act? Explain clearly the danger to personal liberty which it removed.
4. *Geography.—Candidates.*
   (*a*) Say what you can of Lincolnshire. Give a sketch-map.
   (*b*) Describe a coasting voyage from Sunderland to London.

First Year.
   (*a*) Enumerate the chief ports on the Baltic, and say something of the trade of each. What has been done to render the entrance to the Baltic more easy?
   (*b*) Say what you can of the Steppes, Black Lands, Tundras, Crimea.

Second Year.
   (*a*) Give a brief account of our relations with Ashanti.
   (*b*) Mention the six chief British ports in Africa, giving imports and exports to each.

AUTUMN EXAMINATION, 1900.

Twelfth Month—September.

Finish revision of all subjects. The following points should have final revision:—

1. English.

Prefixes, affixes, roots. Life of author, peculiarities in grammar, and the points set out at length in the *Pupil Teacher's English Notebook*.

2. Arithmetic.

The theory of all rules. Great care must also be taken in the method and arrangement of sums.

3. Geography.

Sketch-maps of all countries; the governments, industries, and chief towns.

The special work set should, of course, receive very careful attention, as a question is pretty sure to be set thereon.

4. History.

The chief points indicated during the year.

5. Euclid.

The propositions, and as many deductions as possible.

The following questions, selected from recent Government papers, may be useful in indicating the scope of the various subjects and revealing weak points:—

Geography.

Candidates.

1. Describe the position and most interesting features of one of the five oceans.
2. Where and what are the following:—Amazon, Sahara, Himalayas, Great Barrier Reef?
3. Describe a coasting voyage from Glasgow to Bristol, and illustrate by a sketch-map of either the Bristol Channel or the west coast of Wales.
4. What are the chief industries of Staffordshire, the valley of the Clyde, the province of Ulster?
5. Name the districts most famous for mountain and lake scenery in the British Isles. Describe one of these districts.
6. Draw a map of Wales, showing where the chief industries are carried on, and mark the chief physical features and the position of six large towns.
7. In what English, Scotch, and Irish counties are the linen, cotton, and woollen manufactures chiefly carried on? Say why such localities are suitable for the purpose.
8. Mention five holiday resorts in the British Isles, and say what points of interest a visitor would observe in each.
9. Where are the Chiltern Hills, the North Downs, Lowthers, and Cader Idris?
10. Say what you can of *four* of the following:—Belfast, Killarney, Kirkwall, Ben Nevis, Shannon, Connemara, Plymouth, Grimsby.
11. Describe the islands on the west side of Scotland.
12. London is situated on a tidal river. Name other towns which occupy a similar position, and explain the advantages gained thereby.
13. Describe a journey from London to Cork.
14. What circumstances favoured the establishment of the

following industries at the places where they are found in the British Isles:—Manufacture of cotton goods, earthenware, cutlery, chemicals?

15. Draw a map of Ireland, marking in the provinces and the principal seaports, rivers, mountains, and lakes.

16. Describe the Caledonian Canal, taking particular notice of its commercial value.

17. Say (in about four lines on each topic) what special interest belongs to *four* of the following:—Cove of Cork, Valley of the Dee (Aberdeen), Vale of White Horse, Melrose, Nantwich.

18. Give some interesting information (in about four lines for each) about *four* of these:—Cambridge, Connemara, Dundee, Drogheda, Gap of Dunloe, Pass of Killiecrankie, Lichfield, Peterhead.

19. Write a short account of one of the following:—
(*a*) A week's tour in the Highlands *or* in the Lake District.
(*b*) Edinburgh.
(*c*) The Giants' Causeway.

20. Give position and historical associations connected with Winchester, Peterborough, Shrewsbury, Boston, Scarborough, Cardiff, Stirling, Aberdeen, Cork, and Drogheda.

First Year.

1. Give roughly the boundaries of the Central Plain of Europe, and state what countries or portions thereof it includes.

2. Show that the geography of Central Asia would furnish good illustrations for a lesson on climate.

3. Give the positions of the following, and their most interesting associations:—Hamburg, St. Etienne, Dresden, Versailles, Amritsar, Peshawar.

4. State briefly the most noteworthy facts connected with the commerce of India.

5. Describe the border land between France and Germany, mentioning specially the mountains, rivers, and chief towns, and illustrating your answer by a sketch-map.

6. "Russia may be divided into three great districts as regards its natural productions." Say where these districts lie, and name the chief productions. What are the chief ports of each division?

7. "Many rivers of India rise in the Western Ghâts and flow eastward." Show that this statement is correct, and give reasons for the fact.

8. The products of Holland, Denmark, and the south of Ireland are somewhat alike. Name the chief things produced, and explain how the circumstances of these countries are suitable for their production.

9. Name two important groups of islands lying off the coast of Asia, and write fully about one of them.

10. Compare the climate of Russia with that of England, and state any circumstances affecting the climate of each country.

11. Give the chief ports on the Baltic Sea, stating the countries to which they belong, and the chief articles which they export.

12. Write a short account of Switzerland, giving—(1) boundaries, (2) industries, (3) languages spoken, (4) names and positions of five important towns.

13. Describe the mountain system of India.

14. Describe briefly the Scandinavian peninsula.

15. Say what you know of the animal, vegetable, and mineral products of British India. What are the monsoons?

16. Describe the position of four of the following, and write three or four lines about those you select:—Kurrachee, Teheran, Philippine Islands, Cabul, Rangoon, Manchuria, Sea of Aral.

17. Mention the chief lakes in Switzerland, and say what you know about one of them.

18. Describe any two islands in the Mediterranean Sea.

19. Why does the water of the Mediterranean Sea contain more salt than that of the Atlantic? What is its effect on the climate of the south of Europe?

20. Write a short account of Japan or Persia.

21. Explain, by reference to the climate of the country, why it is desirable for Europeans in India to spend a portion of the year in one of the hill stations.

22. Describe the course of any two of the following:—Danube, Loire, Indus, Irrawaddy.

23. What rivers rise in the Alps? Briefly describe the courses of two of them.

24. Give a short account of the commerce of British India.

25. Describe a voyage from Brindisi to Calcutta, mentioning the principal places of interest passed, and stating for what they are remarkable.

26. Name the "Six Great Powers" of Europe, and distinguish between their several modes of government.

27. Write brief notes on *four* of the following:—Crete, the Riviera, Gallipoli, Hong Kong, the Deccan, Aden.

(*Continued on page 149.*)

Music.

(Taken in sets of three questions, these are the papers in the last *five* examinations.)

Candidates.—1. What other groups of contiguous scale-tones are separated by the same intervals as—

r m f s l ‖ s l t d' r'

2. Name the following intervals:—

t_1-f, l_1-f, r-d', d-f, r-l.

3. Write over each note and rest in the following its value in pulses or fractions of a pulse:—

| m :-.r :f.m | r :- :- | f : : | s.f :r.m :d ‖

4. What other groups of contiguous scale-tones are separated by the same steps as the following:—

f m r d ‖ l s f m ‖ s f m r ‖

5. Name the following intervals:—

t_1-f, m-d', s_1-f, m-l, f-d'

6. Write over each note and rest in the following its value in pulses or fractions of a pulse:—

| d.t_1:d :m | s :-.l :s | f :- :- | m :-.r :d ‖

7. What other groups of contiguous scale-tones are separated by the same intervals as—

l s f m ‖ s f m r

8. Name the intervals—

s_1-f, f_1-l_1, t_1-s, r-d', m-f

9. Write over each note and rest in the following its value in pulses or fractions of a pulse:—

| s.m:d :r | m :f :m | s.f :m :s | f.t_1:d : ‖

10. State which tones of the scale have above them (*a*) major thirds, (*b*) minor thirds.

11. Rewrite the following in two-pulse measure, halving the value of every note and rest:—

| s :- | m :d | d :- | - :- | d' :- | s :m | m :- | d : ‖

12. Rearrange the following notes in order of ascending pitch:—

m s' f r t s m' t_1 f' r' l

13. What other groups of contiguous scale-tones are separated by the same intervals as—

m f s l ‖ r m f s

14. Name the following intervals:—

m-r', d-f, m-t, d-t, r-d'

15. Write over each note and rest in the following its value in pulses or fractions of a pulse:—

| d :s.f :m. | r :- : | m.s :f.m :r | :m.r :d ‖

First Year.—1. Rewrite the following passage, making a change to the first sharp key at (*a*), and a return to the original at (*b*):—

Key C. (*a*) (*b*)

m s d m fe r l s fe t l fe s r m f t_1 d

2. Write the following intervals:—

Major third above **ray**; augmented fourth above **doh**; perfect fifth below **fah**; minor seventh above **doh**; perfect fourth above **fah.**

3. Rewrite the following in four-pulse measure, doubling the value of each note and rest:—

| m.,f :s. | f :-.r | d.d,r :m,f.s | t_1.l_1 :d ‖

4. Rewrite the following passage, making a change to the first sharp key at (*a*), and a return to the original key at (*b*):—

(*a*) (*b*)

d s m r fe l s d' t s fe l s m l s t d

5. Write the following intervals:—

Minor sixth above **ray**; augmented fourth below **me**; perfect fifth above **te**; minor seventh above **doh**; minor third above **soh.**

6. Rewrite the following in four-pulse measure, doubling the value of each note and rest:—

| m.f :s. | f .,m :r | d.d,r :m,f | m :s | t_1.t_1 :d ‖

7. Rewrite the following on the imperfect method—that is, without change of key :—

s m d' ᵐl, t, d r s, l, t, ʳd s f t, d

8. Name the intervals :—

m-s, m-ta, t,-fe, fe-d'

9. Rewrite the following in four-pulse measure, doubling the value of each note and rest :—

| s :d.m | r.,m:d | l.s :f.m | r.m :d ‖

10. Rewrite the following passage, making a change to the first sharp key at (*a*), and a return to the original at (*b*) :—

(*a*) (*b*)

s f m s l fe s r' t s fe r m s f r d

11. Name the following intervals :—

m-s, s-d', d'-m', m-t, t,-f

12. Write out the following in three-pulse measure. The figures show duration in pulse :—

1½ ½ ½ ¼ ¼ ½ ½ ¼ ¼ ¼ ¼ ½ 2 ½ ½ ¼ ¼ ¼ ¼ ¼ ¼ ½

s f m f s rest r r m f s l s rest f m r m t, d rest

13. Rewrite the following on the imperfect method—that is, without change of key :—

d s ᵐt, f r m l f r ᵐl t d' s m d

14. Name the following intervals :—

r-fe, s-ta, m-d', d-fe

15. Rewrite the following in two-pulse measure, halving the value of each note and rest :—

| s :-.f | m :s.m | d :-.m | r :- | m : | f :-.m | s :r.m | d : ‖

Second Year.—1. Name the intervals formed by each of the following notes with the others :—

se, t, r f

2. Write out distinctly the following passage in four-pulse measure. The figures show duration in pulse or fraction of a pulse. Begin on a strong pulse :—

1½ ½ ½ ½ ½ ½ 1½ ½ 1 1 ¾ ¼ ½ ½ ½ ½ ½ 2 1 1

m s f r f l s m s rest d r m s f r l, t, r d rest

3. Explain briefly the meanings of the following terms :—*Vivace, andante, accelerando, crescendo, sforzando.*

4. Name the intervals formed by each of the following notes with the others :—

r f se d'

5. Write out distinctly the following passage in four-pulse measure. The figures show duration in pulse or fraction of a pulse. Begin on a strong pulse :—

2 ¾ ¼ ½ ½ 2 ¼ ¼ ¼ ¼ 1 ⅔ ⅓ ⅓ ⅓ ⅓ 1 ¾ ¼ ½ ½ 1

l s f r rest s d' t l s m r f m r s f m r m d

6. Explain the following terms :—*Forte, legato*, M 60, *adagio, da capo.*

7. Name the intervals formed by each of the following notes with the others :—

se t r' f'

8. Write out distinctly the following passage in four-pulse measure. The figures show duration in pulse or fraction of a pulse. Begin on a strong pulse :—

1 ¾ ¼ 1 1 1½ ½ 1 1

s f m r m d r m rest

9. Explain the meanings of the following terms : — *Lento, allegretto, forte, ritard., presto.*

10. Select from the passage given below pairs of notes which will illustrate (*a*) augmented second, (*b*) diminished seventh, (*c*) augmented fifth :—

d re m f s l t d' de' r'

11. Which one of the following notes is highest and which one is lowest in pitch :—

ray' in Key C, **lah** in Key G, **fah,** in Key F,
me, in Key B♭, **soh,** in Key D?

12. Write out distinctly the following passage in three-pulse measure. The figures show duration in pulse or fraction of a pulse. Begin on a strong pulse :—

1 ½ ½ ½ 1 1 ½ ½ ¾ ¼ 1 1 ½ ½ ½ ¼ ¼ ½ ½ ½

s s f m f r d r m s f m rest d' s r m f t, d rest

13. Name the intervals formed by each of the following notes with the others :—

d r f se

14. Write out distinctly the following passage in three-pulse measure. The figures show duration in pulse or fraction of a pulse. Begin on a strong pulse :—

1½ ½ ¾ ¼ 1 1 ½ ⅓ ⅓ ⅓ 1 1 ½ ½ ½ ¼ ¼ 2

s d' d' t m rest l s m d rest rest m s r m d

15. Explain the meaning of the following terms :—*Staccato, tenuto, mezzo forte, con brio, marcato.*

SCHOLARSHIP EXAMINATION, 1900.

Ninth Month—September.

WORK TO BE PREPARED.

1. *Reading, Repetition, and Penmanship.*—A few minutes' practice daily.

2. *Theory of Teaching.*—Chap. xii., *Scholarship School Management.*

3. *Geography.*
   (1.) Revise the United States.
   (2.) British North America : industries, provinces, towns, and government.

4. *History.*—George IV. and William IV.

5. *Composition.*—One or two essays each week, on such subjects as—The French Revolution ; Thrift ; The Work of Clive in India ; The Famine in India ; The Character of the French ; Scientific Discoveries of the Nineteenth Century ; Modern Warfare ; Swimming.

6. *English.*
   (1.) Prosody ; the laws of verse.
   (2.) Twenty roots and meanings per week.
   (3.) Revise Anglo-Saxon language and literature.
   (4.) *Julius Cæsar*, Act v., Scenes 3 and 4.

7. *Arithmetic.*—Square root and cube root, and their applications.

8. *Algebra.*—Arithmetical progression and general examples.

9. *Euclid.*—Book II., Props. 13 and 14, with six deductions per week.

10. *Elementary Science.*—Elementary astronomy. Measurement of angles by degrees and minutes ; determination of positions of celestial bodies by azimuth and altitude ; apparent motions of moon ; lunar and solar eclipses.

11. *Languages.*
   Latin—*Pliny's Letters*, No. 9. Translation and retranslation. Exercises in grammar and composition weekly.
   French—*Le Trésor*, three pages. Translation and retranslation. Exercises in grammar and composition weekly.

12. *Drawing.*—A freehand copy each week, and exercises in geometry. (Use Macmillan's *Drawing Book for Scholarship Candidates.* See also "Drawing for Scholarship Students," in *Practical Teacher's Art Monthly*, September. Price 2d.)

13. *Music.*—Chap. ix., *School Music Teacher.*

14. *Domestic Economy.*—Revision of food.

Notes on the Work for the Month.

1. *Geography.*—In revising the geography of the United States, particular attention should be given to the following points :—(1) Climates and productions. Note the different districts—the Pacific slope, the plateau, the central plain, and the Atlantic slope ; each has its characteristic climate and productions. (2) Industries. (3) Railways. (4) States and chief towns. (5) Method of government.

The government is a federation of forty-five states and six territories. Each state possesses a legislature of its own for local affairs, elected by the people. The territories are to some extent controlled by the Central Government. They are at present—New Mexico, Arizona, Alaska, Indian Territory, District of Columbia, Oklahoma.

The Central Government, which meets at Washington in the District of Columbia, consists of—
   (1.) A President, elected by representatives of the states for a period of four years.
   (2.) A Senate. Two Senators for each state are elected by the legislature thereof for six years.
   (3.) House of Representatives, elected by popular vote in each state for two years, the numbers varying with population. At present there are 90 members in the Senate, and 357 representatives and territorial delegates.

Since 1898, when the States became involved in war with Spain, they have started colonial expansion. The Monroe Doctrine (taking its name from the President who formulated it) is that, while the U.S.A. do not interfere in European politics, they do not allow European states to interfere in American politics. This brought England to the verge of war with the

States over the Venezuelan question. This doctrine has, by force of circumstances during the last three years, been to some extent modified.

By the treaty with Spain (signed at Paris, December 10, 1898) the U.S.A. obtained the control of Cuba, the Philippine Islands, the island of Guam (the largest island of the Ladrone group), and the island of Puerto Rico.

In 1899, by the Samoan Convention, several islands in this group were reserved to the U.S.A. In 1898, by a resolution of Congress, the Hawaiian or Sandwich Isles were annexed.

The constitution of the Dominion of Canada is somewhat similar to that of the United States. The Governor-General represents the Queen. There is an Upper House or Senate consisting of 81 members, and a House of Commons, elected every five years at longest, of 213 members. The provinces have a local government of one or two Houses.

In 1882 the provisional districts of Assiniboia, Saskatchewan, Alberta, and Athabasca were created, the seat of government being Regina; responsible government was granted in 1890. Keewatin was made a district in 1876. In 1895 the remaining territory was divided into Ungava, Mackenzie, Franklin, and Yukon, the last being made a separate territory in 1898 owing to the influx of miners to Klondike.

Note that Newfoundland, with the adjacent coast of Labrador, does not belong to the Dominion.

The history of Canada should be prepared with this month's work. (Use *The Building of the British Empire*—Meiklejohn's series.)

2. *History.*—Catholic Emancipation, the agitation for Reform, the Reform Bill, and the abolition of slavery are the main points to notice.

3. *English.*—In learning the various measures, the following lines of Coleridge will help both in nomenclature and example:—

Trochee | trips from | long to | short
From long to long in solemn sort

Slow spon | dee stalks | strong foot yet | ill able

Ever to | come up with | dactyl tri | syllable

Iam | bics march | from short | to long |

With a leap | and a bound | the swift an | apests throng ||

One sylla | ble long with | one short at | each side

Amphibrach | ys hastes with | a stately | stride.

Note also what is blank verse, heroic measure, etc.

4. *Arithmetic.*—The method of obtaining the square and cube roots must be learned and practised. The examples given for exercise in the text-book on the application of these rules must have careful attention. Note the following type of question, which has been set several times in examinations: "What is the smallest number by which 19404 must be multiplied to make a perfect square?"

To solve this, split up the number into prime factors. These are—$2 \times 2 \times 3 \times 3 \times 7 \times 7 \times 11$. Hence it is obvious that, to make a perfect square, the number must be multiplied by 11.

5. *Domestic Economy.*—In revising section on Food, the following questions, taken from Scholarship papers, may be useful:—

(1.) What are the special advantages of fish as an article of food?

(2.) Give the names of six of the most important cooking utensils for a poor man's family, and explain their use.

(3.) What are the different methods of cooking butcher's meat? State why one method may not suit a particular piece so well as another, and give an example.

(4.) What are the ingredients in a loaf of wheaten bread? What other kinds of bread are there, and why is one to be preferred to another?

(5.) What kinds of food are specially useful (*a*) for maintaining the heat of the body, (*b*) for forming flesh, and (*c*) for forming bone? What names are given to these several kinds of food, and why?

(6.) What are the advantages of stewing meat? Give a recipe for an Irish stew, and say how you would choose the pieces of meat most suitable for your purpose.

(7.) Which are the most economical vegetables for use in a poor man's home? Say at what seasons each of them can be best obtained, and what should be the price.

(8.) The food-stuffs on which man subsists may be divided into two well-marked groups—nitrogenous and non-nitrogenous. Explain what this means, and why these terms are used.

(9.) What are the chief purposes to be served by taking food? Name several articles which are respectively suited to serve each of these several purposes.

(10.) Why do persons who live a sedentary life require less food than those who work in the open air?

(11.) What is the function of yeast in the making of bread? Discuss the merits of white and brown bread respectively.

(12.) How would you define food? Upon what properties do the nutritious qualities of the following depend:—Bread, potatoes, fish, bacon, jelly, butter?

(13.) Describe the various ways in which eggs may be used in cooking.

(14.) What precautions will you take to secure pure milk? How may it be kept from turning sour? Show that milk is rightly termed a model food for young children.

(15.) What properties do you expect to find in a perfect food? To what extent do you find them in (*a*) meat, (*b*) bread and butter, (*c*) cheese, (*d*) green vegetables?

Test Questions.

1. *Penmanship.*
Large Hand:—*Ornithorhynchus.*
Small Hand:—*I will be here again even with a thought.*

2. Give an account of the Congo Free State, saying what you can of its administration.

3. "Canada possesses every variety of climate and vegetable productions, and vast sources of mineral wealth." Comment on this statement.

4. Describe a journey by the Canadian Pacific Railway from Montreal to Vancouver.

5. To what causes do you mainly attribute the failure of the Stuarts to win back the English crown in (*a*) 1715, (*b*) 1745?

6. What effect had the French Revolution on the leading English statesmen of the time—Pitt, Burke, Fox?

7. What allies did the American colonies obtain in their war for independence? Why did each of them join in the contest? Why did Canada remain loyal?

8. What do you know of the smelting of copper? What are its commonest compounds?

9. Describe the working of a building society *or* a co-operative society.

10. Translate into French:—This is the story of a French duke who had nothing left in the world since his family property had been confiscated. His ancestor had placed a box in a hiding-place which he had caused to be constructed in the chimney; in it were some diamonds and a pearl necklace, which the duke hoped to sell for three hundred thousand francs. Unfortunately, it turned out (*se trouver*) that the jewels were false, although (*bien que* with subjunctive) his grandmother had long worn them at court.

11. Write an essay on Australian Federation.

CORRESPONDENCE: RULES (as usual).

All communications and queries with regard to the PUPIL TEACHERS' AND SCHOLARSHIP COURSE should be addressed to "Mr. A. T. Flux, The Bays, Belvedere, Kent."

Answers to Correspondents.

E.O.S.—See rules. I cannot undertake to mark answers to all questions gratis.

Dunce.—Essay, 17/20; Penmanship, 13/20; Geography, 15/20; History, 16/20; Grammar, 17/20.

Agri.—Essay, 15/20. Take care in the use of participles—for example, "Now picking blackberries or plucking flowers, the ground is covered," etc. To what does "picking" refer to in the sentence?

G. W.—Essay, 17/20.

(*Other Correspondents answered by post.*)

Ready in September.

CORNELIUS NEPOS:
LIVES OF MILTIADES AND EPAMINONDAS.

Text, Translation, Notes, etc.

With every possible help for

SCHOLARSHIP STUDENTS, 1901.

By C. J. Phillips, M.A.,

Latin Master, Stockwell Pupil Teachers' Centre.

THOS. NELSON AND SONS, 35 and 36 Paternoster Row, London, E.C.

OUR CERTIFICATE COURSE FOR 1901.

BY GEORGE COLLAR, B.A., B.SC.,

Head-Master of the Stockwell Pupil Teachers' School.

TEST QUESTIONS ON LAST MONTH'S WORK.

Theory of Teaching.

1. Give twelve words the spelling of which presents difficulties, and say how you would deal with them.
2. What is meant by the "extension" of a term? Arrange the following in the order of their extension:—Biped, Parisian, vertebrate, Frenchman, European, animal, man.

Arithmetic.

1. Prove that any prime factor found in a square number must occur in it an even number of times.
2. What is meant by the L.C.M. of two or more numbers? State the ordinary rule for finding it, and show that the working may generally be reduced.

English Grammar and Literature.

First Year.—Analyse the following:—

"I wish I were where Helen lies!
Night and day on me she cries,
And I am weary of the skies
For her sake that died for me."

2. Give an account of the structure of Gray's Ode on "The Bard."

Second Year.—1. Give an outline of Macaulay's connection with *The Edinburgh Review*.

2. Explain the following:—

(*a*) "Anon they move
In perfect phalanx to the Dorian mood
Of flutes and soft recorders."

(*b*) "That small infantry
Warred on by cranes."

(*c*) "The heroic race.....
That fought at Thebes and Ilium, on each side mixed with auxiliar gods."

(*d*) The words:—*begirt, jousted, amerced, meteor, uxorious, grunsel-edge, promiscuous.*

Geography.

Both Years.—1. Describe the extent of the dominions of Charlemagne, and say how they were divided up after his death.
2. Trace the power of the Moors in South-Western Europe.

History.

1. Summarise the events which occurred while the "Legislative Assembly" was in power.
2. Describe the attitude of England towards the French Revolution up to July 27, 1794.

Algebra.

Women—Both Years.—Prove the "Rule of Signs."

Men—First Year.—1. Express as the product of three factors—

$$3a(2a^2 + b^2) + 9a^2b + b(a + b)(2a + b).$$

2. Simplify—

$$\left(\frac{1}{2a + b} + \frac{1}{2a - b} - \frac{3a}{4a^2 - b^2}\right) \times \frac{4a^2 + 4ab + b^2}{2a - b}.$$

Men—Second Year.—1. (*a*) In how many ways can a council of 7 members be chosen out of 11 candidates? (*b*) In how many ways could the council be chosen so as to contain two assigned candidates?

2. Find the condition that the equations $x^2 + px + q = 0$ and $x^2 + p'x + q' = 0$ may have a common root.

French.

Translate:—

"Regardez: les enfants se sont assis en rond.
La mère est à côté, leur mère au jeune front
Qu'on prend pour une sœur aînée;
Inquiète, au milieu de leurs jeux ingénus,
De sentir s'agiter leurs chiffres inconnus
Dans l'urne de la destinée."

NOTES AND SYLLABUS FOR SEPTEMBER.

Composition.

Prepare essays on the following subjects:—

1. The Blessings of Sight.
2. The Study of Natural History.
3. English Scenery.

The students who feel any difficulty in preparing their essays will be able to find much help in the volume of *Short Essays* (Moffatt and Paige).

Theory of Teaching.

Second Year.—Methods of teaching writing.

First attempts at analysis of script forms by Mulhaüser. The advantages of his system:—(*a*) It was a *system*, and brought order out of chaos in teaching writing. (*b*) It permitted unlimited practice in the elements. (*c*) It gave a standard by which writing could be judged. Its faults were:—(*a*) Too great a slope, although, as this was arbitrary, it could be modified while retaining the other points of the system. (*b*) The oblique lines, while offering a valuable guide to the beginner in the matter of spacing *some* letters, was a hindrance in other cases. (*c*) The mechanical help given in the early stages is of doubtful utility.

Most systems begin by teaching the elements, but avoid the rhomboid spaces. The student should consider carefully the following points, so as to be able to discuss them:—(*a*) Tracing; (*b*) headline copy books *v.* blackboard copies; (*c*) movable slip copies; (*d*) size of writing; (*e*) characteristics of good writing; (*f*) order of teaching the letters—similar forms to be taught together; (*g*) advantages and disadvantages of different writing materials.

Logic.—The nature of judgments, and relations of the propositions in which they are presented. Welton is very clear on this subject. Study carefully chaps. v., vi., vii. Jevons hardly touches on the first part of this month's work, but deals fully with the kinds and relations of propositions. The relation between the judgment or mental act and the proposition or form of words expressing it is so close that a careful study of the one carries the student almost through the study of the other.

Arithmetic.

Vulgar Fractions.—The points to be especially attended to are:—Definitions; proofs of rules; concrete and graphic illustrations to be used in teaching the rules.

English Grammar and Composition.

First Year.—*Lyra Heroica*, xxxiv.–lxiii.

Prepare an account of the leading facts in the life of the author of each poem. Avoid all details, but note such points as you consider may have had an important influence on his writings. Thus, without troubling about exact dates, fix in your mind the *period* through which the writer lived, and observe which events in the world of politics, religion, literature, or society had most influence on the author.

William Cowper (pronounce Cooper). Born 1731. Educated at a private school, and afterwards at Westminster School, where Charles Churchill (the melancholy poet) and Warren Hastings were among his schoolfellows. He was articled to an attorney, but had no taste for the law; and his melancholy disposition led to his attempted suicide, and to the necessity of his being carefully watched by his friends. On leaving the asylum he retired to the house of the Rev. Mr. Unwin at Huntingdon; and on the death of Mr. Unwin he removed with Mrs. Unwin to Olney, on the borders of Bedfordshire and Buckinghamshire. Here he wrote the well-known *Olney Hymns*, and also his great work *The Task*. In August 1782 the nation was plunged in sorrow by the loss of the *Royal George*, and the following month Cowper wrote the poem in our collection. He died in 1800. His poems are marked by a natural style, with occasional gentle irony, and reflect the piety, melancholy, and love of nature which filled his life. Few explanatory notes are necessary.

xxxiv. *Made the vessel heel.* The guns had been placed on one side of the ship to make the other tip up a bit, so as to admit of cleaning; but the weighting was overdone, and before the order could be given to replace the weights the vessel went right over and sank.

xxxv. *The progeny.* The Druid assumes that those who command the "regions Cæsar never knew" are the descendants of the ancient Britons only.

xxxvi. Many of our readers know Sullivan's music to this song.

Trow me, though no one else trusts me. The general meaning of *to trow* is "to believe to be true."

I'll dight me, I'll cover myself. Dight or deck (= to cover) is allied to *thatch* and *deck*, the covering part of a ship.

XXXVII., XXXVIII. These two lyrics of Dibdin's are set to music in Hatton's *Songs of England;* and, indeed, the beautiful monody "Tom Bowling" is one of the most popular songs in the English language.

By the board, over the side of the vessel. The left side of the ship, looking forward, is the larboard (or port), and the right side is the starboard.

Notice the nautical *metaphors* in which the sailor's heart is spoken of as a ship.

Scud, from the same root as *shoot*.

Flip, a drink containing whipped eggs. *Flip* is related to *flap*, to beat, to move up and down.

Sheer hulk, a mere useless old vessel: *sheer* = pure; *hulk* = literally, a *heavy* ship.

Broached him to—literally, fastened him up to a peg or pin, just as a ship is fastened to a post along the quay. It must not be confused with the word in the expression "to broach a cask," which means to pierce it, although both verbs come from the same Low Latin word *broccus*, a sharp-pointed stick, as does also the word *brooch*.

Aloft. *A = on; loft*, the upper part, from the same root as *lift*.

Doffed, taken away. *Doff* is from *do off*, just as *don* is from *do on*, and *dout* (a fire) from *do out*.

XL. *Stemmed* = cut through. The *stem* of a vessel is the upright piece of wood which forms the front of the ship; hence "from stem to stern" means the whole length of the ship.

Spring fleet. During part of the wars against France the British ships were called into port for the winter, and sent out in the spring. (See our History notes in November.)

Sheet, a rope for holding a sail, *not the sail itself*. *A tack* is also a rope for holding a sail.

To our Admiral's lee, to the side of our Admiral's ship away from the wind. The windward position was the more advantageous, hence a ship would not go to the lee of her opponent unless obliged.

XLII. *Distain*—literally, take away the stain or colour from his name.

XLIII. *Braid* = broad.

XLIV. *Tassie*, cup; Fr. *tasse*. The political relations between France and Scotland before 1603 led to the introduction of many French words: compare *bonnie*, from Fr. *bon*.

XLV. *Yestreen* = yester even; last night.

Lee-lang = livelong.

XLVII. On the founding of Venice, see our Geography notes for July.

A Mate. The allusion is to the quaint Venetian ceremony in which the Doge annually went in procession into the open Adriatic and dropped a ring into it, symbolically "espousing the everlasting sea."

The four beautiful selections from Wordsworth may be taken as illustrating the structure of a *sonnet*. The late Professor Morley says:—

"The true sonnet consists of two quatrains and two terzettes. In the two quatrains, forming the first eight lines, there are only two rhymes, with their order fixed for the first quatrain, where it is *a b b a*, but not for the second. These quatrains open the subject. The expression of the thought for which the sonnet is written falls within the two terzettes, and here vigour of expression is less cramped by restriction in the rhyming: while there are but six lines, there are three rhymes, and they may be arranged at the discretion of the poet, energy of expression being at its height in the last line."

In the first and second of our four sonnets it will be seen that the rhyme of the sixth and seventh lines differs from that in the second and third. The terzettes of the first two rhyme *a b a, b a b*; of the third, *a b c, b a c*; and of the fourth, *a b b, c a c*.

LI. *Thou love*. Notice the use of the subjunctive mood after "if."

LIII. *Gadite*, belonging to Gades, Cades, or Cadiz, as the name is varyingly spelt.

Palinure. Palinurus was the pilot in the ship of Æneas. The name is now used for any pilot. Pitt is regarded as the pilot of the state.

Rivni. The tombs of Pitt and Fox are close together in Westminster Abbey.

Requiescat, the prayer for the repose of his soul. The Latin prayer, "Requiescat in pace" (= May he rest in peace) is sometimes represented by the initials R.I.P.

Agen, the old spelling of *again*, which should still be pronounced *agen;* see the rhymes in poem L.

Spells.....sky. Paraphrase thus:—No grave wizard ever produced such powerful spells, although he might produce some strong enough to drain the ocean and drive the planets from the sky.

On the lees. The sediment which collects at the bottom of a wine cask is called the "lees," and when the cask is nearly empty, and the wine begins to run out thick, it is said to be "on the lees."

Since LIII. bears on some great characters in our History course, students are advised to commit it to memory.

The other selections from Scott are well known.

SECOND YEAR.—Read to the end of Macaulay's *Life and Letters*, chap. v. Finish the first book of *Paradise Lost*. We should like to add the edition of *Paradise Lost*, I., II., published by Messrs. Moffatt and Paige, to those we named in our first list; the notes are very full and carefully arranged.

GEOGRAPHY.

BOTH YEARS.—Study the changes brought about in Europe by political developments—such as, the continental possessions of the English kings; the development of the German states, particularly of Prussia. This is well set out in Macaulay's *Essay on Frederick the Great*, which most of our students have read. The rise of the temporal power of the Pope and the development of the kingdoms of Italy form the subject of an interesting volume in the *Story of the Nations* series. We have seen how in Spain the provinces of Aragon and Castile were united, and the Moors subjugated and expelled, after the conquest of Granada.

The Holy Roman Empire had undergone great changes, when Charles, the grandson of Ferdinand and Isabella, became Emperor, and revived the power and grandeur of the empire. It is important to notice whence he derived his immense possessions. (i.) He inherited Spain from his grandparents (on his mother's side), Ferdinand and Isabella; (ii.) from his father, Philip of Austria, he inherited the Austrian dominions; as also (iii.) Burgundy and the Netherlands from his father's mother, Mary of Burgundy; (iv.) from Ferdinand he also inherited Sicily, Sardinia, and the kingdom of Naples—that is, the whole of the southern portion of Italy.

France was developing by extending its power over the provinces. Brittany became an integral part of France by the marriage of Anne of Brittany with Charles the Eighth. In 1552 Henry the Second of France acquired the temporal possessions of the three German bishoprics—Toul, Verdun, and Metz.

In 1609 the Dutch established the independence of their country in fact, although it was not acknowledged till the peace of Westphalia, 1648, which also acknowledged the independence of Switzerland. This peace, which closed the Thirty Years' War, gave to Sweden large parts of the "Empire"—part of Pomerania and the possessions of Bremen, Verden, and Wiemar. France obtained Alsace, with the exception of the free city of Strasburg. The acquisition of immense and rich colonies in America, India, and Africa from this time began to affect the wealth and power of Spain, Holland, Great Britain, and Portugal; but, beyond noting this, we cannot discuss the question of colonisation in the Geography.

Under Louis the Fourteenth various changes took place. The reader has become familiar with the Wars of the Spanish Succession, brought about by the revival of claims to the inheritance of Maria Theresa which were renounced when she married Louis. By the treaties of Nimeguen (1678–79) France gained parts of the Netherlands and the country of Burgundy. Later on, Louis annexed Strasburg and other free towns which were in Alsace, and in 1688 he seized Avignon, which belonged to the Pope.

By the treaties of Utrecht and Rastadt, which closed the Wars of the Spanish Succession, England acquired Gibraltar and Minorca; France retained her possessions; Spain lost Sicily, which was ceded to Savoy; Milan, Naples, Sardinia, and the Netherlands were ceded to the Emperor, and gained more internal independence.

The treaty of Lisbon, 1688, again made Portugal a separate kingdom.

The Electorate of Brandenburg received substantial additions by the treaty of Westphalia, and Frederick William, the Great Elector, made his possession, the Duchy of Prussia, independent of Poland. His son was first king of Prussia, and his grandson received further additions by the treaty of Utrecht, and was acknowledged as *king* of Prussia by Louis the Fourteenth.

HISTORY.

BOTH YEARS.—In selecting the five Directors, it seemed as though the chief qualification was the fact of having signed the king's death warrant. With the exception of Carnot (grandfather of the late President Carnot), they were men of very little influence. The Directory had to deal with a corrupt state of morals, disappointed royalists, and disappointed extremists of the other side. They acted with decision, put down the royalist rising in the west, and executed Babœuf, who was organising an

insurrectionary committee. To meet these internal troubles, and to carry on the war against England, Austria, and Piedmont, the Directory could only avail themselves of a discredited paper currency, which at one time was worth no more than the one-thousandth part of its nominal value.

Owing to the ineffective way in which our ships blockaded the French ports, two French expeditions sailed for Ireland. They were both unsuccessful, although the one that reached Bantry Bay was well planned, and might have succeeded had its different parts not been prevented from meeting by fog.

By the admirable way in which war was carried on against Austria, Carnot earned for himself the name of Organiser of Victory. The strategy consisted in moving one army under Jourdan by the valley of the Main, and another under Moreau by the valley of the Neckar, to meet in the valley of the upper Danube and advance on Vienna. The Archduke Charles, however, defeated Jourdan at Würzburg and Altenkirchen; and Moreau, finding himself isolated in Bavaria, was obliged to retreat by the "Val d'Enfer," south of the Black Forest. The next year, Hoche, who succeeded Jourdan in command, recrossed the Rhine, and gained the battles of Neuwied, Ukerath, and the second battle of Altenkirchen; but he was prevented from following up his successes by the action of Bonaparte, who forgot that the duty of a general is to fight, and leave treaties to diplomatists.

While the above was taking place, General Bonaparte had been sent with an army of picked men, and such generals as Massena and Augereau, into Lombardy. He crossed the Alps, as the English fleet was ready to assist the Piedmontese to cut his lines of communication had he attempted to follow the usual road along the coast. Following his usual plan, Bonaparte managed to separate the Piedmontese from the Austrians, and after defeating the latter at Mondovi, obliged them to sign the peace of Cherasco, ceding Nice and Savoy to France. After the battle of Lodi the Austrians were driven out of Lombardy into the Tyrol, and Bonaparte set himself to work to organise Lombardy and reduce the smaller Italian states. In order to crush him, four great Austrian armies were sent against him. The first was defeated at Lonato and Castiglioni, the second at Primolano and Bassano, after which the remains of both parts shut themselves up in Mantua, where Bonaparte besieged them. The third army was now closing on Bonaparte, so he withdrew all available men from the siege of Mantua, and defeated the Austrians at Arcola on the Adige. The fourth army was in its turn defeated at Rivoli (January 1797). Mantua capitulated the next month. The few troops that Austria could send to oppose Bonaparte's march through the Tyrol were easily defeated at Neumark, and the advanced guard of the French came in sight of Vienna. The preliminary agreement was drawn up at Leoben, and resulted in the definite treaty of Campo-Formio.

England was left to continue the struggle single-handed, and agreed to a conference at Lille to settle terms of peace. The representatives were, however, unable to come to terms.

Disorder was increasing in France, and the Treasury was obliged to cancel part of its obligations, and its creditors lost about 80 per cent. of their due. Things were evidently leading up to the government of a single ruler. The two most popular men in France were Lazare Hoche and Bonaparte. The former, a high-spirited, patriotic general, died at the early age of twenty-nine.

After the ineffective conference at Lille, the Directory wished Bonaparte to invade England; but he persuaded the Directory that he could do England more harm by invading Egypt, opening up a land route to India, and overthrowing the English power there.

In May 1798 the French fleet left Toulon, and evaded Nelson, who was in command of the Mediterranean station, and reached Alexandria. Bonaparte defeated the Egyptians first at Chebreiss, and then in the celebrated battle of the Pyramids, and General Desaix gained the victory of Sediman. The French were, however, soon shut up in their conquered territory; for Nelson came up with their fleet, lying at anchor in Aboukir Bay, and completely destroyed it. Bonaparte took such measures as he could to secure a hold over Egypt for France, and determined to return the next year by way of Syria. The mountains of Palestine obliged him, as they had done the Crusaders and Pharaoh-Necho (2 Kings xxiii.), to keep by the coast, and pass between Mount Carmel and the sea. The passage of this defile was commanded by the fortress of St. Jean d'Acre and the English fleet under Sir Sidney Smith. After spending five months in besieging this town, Bonaparte was obliged to raise the siege and return to Egypt. In order to combat a second coalition which was being formed against France, Bonaparte left his army in Egypt and returned to France. By the time he arrived the coalition had been broken up by the defeat of the Russians at Zurich. Bonaparte, however, relying on the popularity he had acquired, especially in the army, brought about a *coup d'état* by which a Consulate of Three, with himself as First Consul, was substituted for the Directory of Five.

Most of our readers will be able to read *Le Directoire*, by Madame de Staël.

Algebra.

Women—Both Years.—Factors (see last month's paper for men); G.C.M. Notice how this rule depends on the same three fundamental principles as that in arithmetic. The common factors of two quantities must be found in the sum or difference of any of their multiples, consequently we may remove or insert any factors which are not common without affecting the result. By this time our readers should be able to factorise *any* expression involving three terms, and many involving more than three. Much labour will be saved if the expressions in hand at any stage are factorised whenever possible. Of two expressions, always factorise the simpler one first. This is easier in itself, and the factors obtained from it will suggest the forms to try in finding the factors of the other expression, since we know that some factors are common.

Men—First Year.—Practise simplification of fractions by factorising numerators and denominators. Revise the theory of quadratic equations. It must be remembered that when an equation has been reduced to the general form $ax^2 + bx + c = 0$, then, if p and q are the roots,

$$p + q = -\frac{b}{a}, \text{ and } pq = \frac{c}{a}.$$

This theorem is most important, as it enables a quadratic equation whose roots are rational to be solved by factorising. The method of completing the square is long, but it is general, and the student should practise it in order to become familiar with the proof of the formula—

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a},$$

which gives the roots of the equation $ax^2 + bx + c = 0$. Like other formulæ, it should never be used mechanically, but only when its true meaning has been fully mastered.

Men—Second Year.—Study the principles of mathematical induction. This is a form of reasoning which shows that if a result is true for $x + 1$ because it is true for x, and if it is true for any one particular value of x, then it is true universally. For instance, we can prove that the sum of

$$\frac{1}{1.2} + \frac{1}{2.3} + \frac{1}{3.4} \cdots + \frac{1}{n(n+1)} = \frac{n}{n+1}.$$

If the formula is true for k terms, the last term being $\frac{1}{k(k+1)}$, the sum would be $\frac{k}{k+1}$, the next term being $\frac{1}{(k+1)(k+2)}$. We find by adding this to $\frac{k}{k+1}$ that we obtain

$$\frac{k}{k+1} + \frac{1}{(k+1)(k+2)}$$
$$= \frac{k(k+2)+1}{(k+1)(k+2)} = \frac{k^2+2k+1}{(k+1)(k+2)} = \frac{k+1}{k+2},$$

which form would be obtained by changing k into $k + 1$; but if $n = 1, 2, 3$, or 4, the value is correctly given as $\frac{1}{2}$, $\frac{2}{3}$, $\frac{3}{4}$, or $\frac{4}{5}$, hence the formula is true universally. The theorem must be understood before the binomial theorem can be grasped.

Euclid.

Women—First Year.—Props. 8–15. Remember them in pairs as far as possible.

Second Year.—Book II., 7 to 10.

In 7, observe that the corner square is counted twice.

In 9, first prove the triangles of the figure to be right-angled and isosceles, then the rest is proved by I. 47.

Compare 10 with 9. Notice that the point D has changed position, and instead of being *on* the line is on the line produced.

Men—First Year.—III. to end of Prop. 8.

Second Year.—Read the definitions of the fifth book, and prepare VI. 1–4.

Latin.

See The Practical Teacher Matriculation Course.

French.

Revise the conjugations of the verbs. Study carefully the formation of tenses. Read *Le Roi des Montagnes*, pages 45–64, and work Exercises 6–8.

AUTUMN EXAMINATION, 1900.

(*Continued from page 143.*)

THE following questions have been selected from recent Government papers, and will be found useful in indicating the scope of the various subjects and revealing weak points :—

GEOGRAPHY. *Candidates.*

Second Year.

1. Compare the physical features of South Africa with those of Australia.
2. Explain the terms :—Karroo, llano, prairie, geyser.
3. Show, from the geography of Canada and South Africa, the relation between climate and certain productions.
4. Where are Ballarat, New Orleans, Port Elizabeth, Bathurst, Kingston, Dunedin, St. Louis? What is the special importance of each place?
5. Describe generally the boundary between adjoining parts of Canada and the United States, and illustrate your answer by a sketch-map.
6. Give a short account of New Zealand, referring specially to its native race, its volcanic agency, and its suitability for English emigrants.
7. Account as fully as you can for the fertility and present importance of Egypt, and describe the position of Cairo, Port Said, Alexandria, and Khartoum.
8. Name four of the principal productions of the United States, and say what towns are specially interested in each product.
9. A great hindrance to progress in Africa is the difficulty of enlarging production. Show as carefully as you can how this difficulty is being removed.
10. Describe the basin of the Murray River. To what disadvantages are the Australian rivers subject?
11. "The Dominion of Canada contains all kinds of climates, all sorts of productions, every variety of mineral wealth." Comment on this statement.
12. What would be the approximate time for a letter to travel from (*a*) London to Edinburgh, (*b*) London to Quebec, (*c*) London to Melbourne; and what would be the cost of postage supposing the weight of the letter not to exceed one half-ounce?
13. It is proposed to construct a railway from Cape Town to Cairo. Describe briefly the suggested course of such a railway, and write what you can about the portion already completed.
14. Which of the United States border the Gulf of Mexico? Say what you can about the climate and productions of one of them.
15. From which of our colonies do we chiefly obtain wheat, wool, gold, copper? Describe the course of a vessel bringing one of these articles to England.
16. Give a short account of the Philippines or of Cuba, and mention any results likely to follow from recent events.
17. Describe as fully as you can the industrial pursuits of British North America.
18. Describe the physical features, chief towns, and industrial pursuits of Tasmania *or* South Australia.
19. Enumerate and describe the West African possessions of Great Britain.
20. Give a brief description of Egypt.
21. Describe the position of *four* of the following, and write three or four lines about those you select :—Cairo, Timbuctoo, Philadelphia, Valparaiso, the Mississippi, Johannesburg, the Soudan, Florida.
22. Write a full description of the mode of government of the Dominion of Canada *or* Australia.
23. What do you know of Australian Federation?
24. Describe the various products of Cape Colony, and give the position of the ports from which they are exported.
25. Write what you know about the Gulf Stream.

HISTORY. *Candidates (all below.)*

First Year.

1. Give some account of the chief explorers of the reign of Elizabeth.
2. State what you know of the causes and results of the quarrel between King John and the church.
3. Relate shortly the events which led to the Norman Conquest.
4. Give the dates and results of the following battles :—Stamford Bridge, Lewes, Falkirk, Agincourt.
5. What was the Black Death, and what effect had it on England?
6. How did the Feudal System as established by William the First in England differ from the Feudal System as it existed elsewhere?
7. Explain the terms :—Shire, Witenagemote, Viking, Danelaw, Fyrd.
8. Give a short account of the reign of Alfred the Great after the Peace of Wedmore.
9. What do you know of the Salisbury Decree (1086), the Assize of Arms (1181), Magna Charta (1215), Provisions of Oxford (1258)?
10. Say what you know of any three of the following :—Agricola, Canute, Hereward, Henry the First, Hubert Waller, Hubert de Burgh.
11. Explain the grounds of Edward the First's interference in Scottish affairs, and say what you know of Wallace.
12. What was the claim of Henry the Fourth to the throne? Why did the power of the Commons increase in his reign?
13. What were the causes of *two* of the following :—Statutes of Labourers (1347 and 1562), Solemn League and Covenant (1643), Navigation Act (1651)?
14. What were the chief causes and immediate results of the Peasants' Revolt in the reign of Richard the Second?
15. State very briefly the circumstances which led to any three of the following battles :—Bannockburn, Shrewsbury, Bosworth, Flodden, Langside.
16. What do you know of the Puritans in the reign of Elizabeth?
17. What steps were taken by William the Conqueror and William Rufus to lessen the power of the nobles?
18. Give the character of Henry the Second, and describe the extent of his dominions.
19. Under a weak king the power of the barons in England always increased, and under a strong king decreased. Illustrate this from the reigns of Henry the First and Henry the Third.
20. Show how the reign of Edward the Confessor prepared the way for the Norman Conquest. On what grounds did William base his claim to the English crown?
21. What were the main points of the Charter of Henry the First? What other popular measures did Henry adopt at his accession?
22. Trace the causes of the growth of the opposition party to the government of Henry the Third.
23. Give a short account of the closing events of Edward the Third's reign.
24. What beneficial results may be traced to (1) the Black Death, (2) the loss of English possessions in France?
25. What do you know of two of the following :—Bede, Edmund Ironside, Simon de Montfort, Hubert de Burgh?
26. What foreign lands were ruled over by Henry the Second? Mention any that were lost by England before 1307, and say in whose reign the losses occurred.
27. Tell the story of the quarrel between King John and the Pope.
28. Show how very similar were the causes which led to the depositions of Edward the Second and of Richard the Second, and how similar was the action of Parliament in each case.
29. What led to Jack Cade's rebellion? Give a short account of it.
30. Give a short account of the Spanish Armada.
31. Give an account of some of the chief reforms introduced by Henry the Second.
32. Who and what were Dunstan, Wallace, and Hereward?
33. What causes led to the success of Edward the Fourth in the Wars of the Roses?
34. Describe England's relations with other countries during the reign of Elizabeth.
35. Narrate briefly the chief incidents in the reign of Henry the Seventh.
36. What was the ground of the claim made by Edward the Third to the throne of France? Give a brief account of the war which followed.
37. Explain by a genealogical table the blending of the White and Red Rose in the Tudor line.
38. Say what you can of two of the following :—Anselm, Odo of Bayeux, Stephen Langton, Eleanor of Castile.
39. Give some account of the struggle between John and the barons.
40. Name, with dates, the events connected with the following places :—Athelney, Stamford Bridge, Northallerton, Evesham, Rochester.
41. Describe, with a plan, the battle of Agincourt.
42. Discuss the grounds on which Mary Queen of Scots was arraigned and condemned.

Second Year.

1. When, and for what reasons, were the duties on corn abolished?
2. Who were Prince Rupert, Sir John Elliot, and Colonel Pride?
3. Give an account of the South Sea Bubble.
4. Say what you know of Monmouth's rebellion.
5. Give an account of Cromwell's foreign policy.
6. When was the Act of Settlement passed? What provision was made for the succession to the throne of England?
7. When was Gibraltar taken? What great attempt was made to retake it, and with what success?
8. "About the middle of the eighteenth century the foundations of the British Empire in the East and in the West were finally secured." Explain this statement.
9. Name some of the important inventions of the present century.
10. Choose three of the following, and say when they lived and why they are famous:—Marlborough, Walpole, Nelson, Wilberforce, Dr. Johnson, Sir Walter Scott.
11. When, and with what results, were three of the following battles fought:—Shrewsbury, Naseby, Drogheda (siege and storm), Worcester?
12. State, in their order, the main events of the reign of James the Second.
13. What were the considerations which led to the Union with Scotland? What were the chief terms of the Union?
14. What do you know of any *three* of the following:—Bolingbroke, Lord North, the *second* Pitt, Canning, Peel?
15. State briefly the course of events in Ireland in the reign of William the Third *or* from 1780 to 1801.
16. How do you account for the distress in England after the battle of Waterloo? What were the Six Acts?
17. What events are connected with the following places (give dates):—Gibraltar, Plassey, Fontenoy, Majuba Hill, Prestonpans, Quebec?
18. What caused the revolt of the Scotch against Charles the First? What part did they take later in the Civil War?
19. What do you understand by the terms "Whig" and "Tory" in the reign of Charles the Second and James the Second? Name three leading Whigs and three leading Tories of those reigns.
20. What events are connected with the following names:—Glencoe, Heights of Abraham, the Nile, Torres Vedras, Sebastopol, Cawnpore?
21. Trace the claim of George the First to the throne.
22. State briefly the main causes which led to the revolt of the American colonies.
23. What was the effect of the French Revolution in England (*a*) upon the governing, (*b*) upon the non-governing classes?
24. What measures of reform are connected with the names of Wilberforce, Peel, Howard, Grey, Shaftesbury?
25. Describe, with a plan, the battle of Waterloo.
26. Name some of the points on which James the First and Charles the First disagreed with their parliaments.
27. Describe briefly the events that led to the Restoration.
28. What arrangements were made at the accession of William the Third with regard to (*a*) the revenue of the Crown; (*b*) a standing army; (*c*) the judges' tenure of office?
29. Give a short account of three of the following:—The King's Friends; the Reform of the Calendar; the Darien Scheme; Abolition of the Slave Trade.
30. What do you mean by Free Trade? Who was the author of the doctrine? What important steps towards Free Trade have been made in England during the present century?
31. Give a short summary of the most important events in connection with the Indian Empire since the accession of Queen Victoria.
32. What allies joined England in the Crimean War? Against whom was it fought? Name, in order, the chief battles.
33. State the causes which led to the execution of the Earl of Strafford.
34. What was the Toleration Act, and when was it passed?
35. Give the main provisions of the treaty of Utrecht.
36. Sketch the main incidents in the career of Robert Clive.
37. What allies did the revolted American colonies find, and with what objects and with what results did those allies join the Americans? Why did Canada remain loyal?
38. What was the Septennial Act of 1716?
39. Give a short account of the administration of Sir Robert Walpole.
40. Describe the battle of the Nile, with a plan.
41. Who were Pope, Watt, Wilkes, Wordsworth, Castlereagh, Cobden; and in whose reigns did they live?
42. What was the importance of the reign of William the Third in English history?
43. Give some account of the aims and actions of William Pitt the younger.

LONDON MATRICULATION.

JUNE 1901.

BY R. C. B. KERIN, B.A. (LOND.),

First in First Class Classical Honours at Final.

LATIN COURSE FOR SEPTEMBER.

1. Sallust, *Catilinæ*, chaps. x.–xvii.
2. *Anglicè Reddenda*, Nos. 11–20.
3. Some sentences each week from one of the books recommended.
4. Grammar.—Declension of adjectives in the accidence. Note the various classes of adjectives, especially those in *er* declined like (1) *tener*, retaining the *e*; (2) *niger*, dropping the *e*. You should learn the list of adjectives in *er* that belong to the third declension and are declined like *acer*. Note that most adjectives of the third declension take the genitive plural in *ium*, except comparatives (*plus* and *complures* take *ium*), and a few words like *vetus*, etc., a full list of which is given in the grammars. You are often required in examinations to decline an adjective and a noun in conjunction. The rules for the ablative singular of third declension adjectives are also important. Note carefully the defective and irregular nouns, especially *bos*, *iusiurandum* (no plural), *supellex* (no plural), *senex* (stem, *sen*; genitive plural, *senum*); heteroclite nouns, or nouns that belong to two declensions, like *vas* and *ingerum*. *Vas*, masculine, is third declension only, and has no genitive plural in use. *Vas*, neuter, "a vessel," is third declension in the singular and second declension in the plural. The declension of *domus* and *laurus* is most important. Remember the rhyme for the former—

Tolle me, mi, mu, mis,
Si declinare domus vis.

Note the various heterogeneous words like *locus* (plural, *loci* or *loca*), *rostrum*. Learn examples of nouns used only (1) in the singular; (2) in the plural, like *exsequiæ*, *tenebræ*. Learn carefully the list of words which differ in meaning in the singular and plural. Among the most important are *aqua*, *auxilium*, *impedimentum*, *copia*, *castrum*, *rostrum*, *facultas*, *opera*, *ædes*, *balneum*. Note the declension of *nemo*. The genitive and ablative are supplied by *nullius* and *nullo*. The genitive of *plerique* is *plurimorum*, though in the nominative and other cases *plerique* means "most," and *plurimi*, "very many."

Typical Sentences.

4. "Every third man will tell your father why we favoured these men."

Cur his favorimus patri tuo (vestro) tertius quisque dicet.

Notes.—(*a*) "Your" can be expressed here either by *vester* or *tuus*—by *vester* if the "your" refers to more than one person, by *tuus* if it refers to only one. This rule is a most important one, as the Romans never use the plural *vos* and *vester* in reference to one person. (*b*) Note that the subjunctive *favorimus*, and not the indicative *favimus*, must be used in this sentence. The verb occurs in a dependent or indirect question.

The Romans considered every sentence an indirect question if it was introduced by an interrogative word, and was at the same time a dependent sentence. Now, in this case, we have the interrogative *cur*, hence the subjunctive. (*N.B.*—The Latin subjunctive in such cases must *not* be translated by "may" or "might" in English, as there is *no* doubt implied. Beginners are often guilty of this mistake. Roughly speaking, "may" or "might" is represented by the subjunctive only in (1) purpose clauses, (2) in wishes. The words "may" and "might" are a very common translation of the Latin subjunctive, and are in most cases erroneously used by beginners to translate this tense.)

Now, with regard to the tense of the subjunctive. The Latin rule for this is very strict, and must be observed by every student. The rule may be stated as follows:—If the verb in the clause on which the subjunctive depends is in a primary tense (that is, in the present, future, future perfect, or present perfect—the perfect with "have" in English), use either the present or perfect subjunctive: the present, if the time of the verb in the subjunctive is the same as, or future to, that of the principal verb; the perfect, if the time of the action of the verb in the subjunctive is antecedent to that of the principal verb—for example, *cur abeat scio*, "I know why he is going away;" but *cur abierit scio*, "I know why he went away." If the verb in the clause on which the subjunctive depends is in a secondary or historical tense—that is, a tense that is not primary—use the imperfect or pluperfect subjunctive: the imperfect, if the action of the subjunctive verb is the same as, or future to, that of the principal verb, or if the action is continuous; the pluperfect, if

the action of the subjunctive verb is antecedent to that of the principal verb—for example, (*a*) *te rogavi ut hoc faceres*, "I asked you to do this;" (*b*) *te rogavi cur hoc fecisset*, "I asked you why he had done this." In (*a*) the action of "doing" is future to that of "asking," therefore the imperfect *faceres* is used. In (*b*) the action of "doing" is antecedent to that of "asking," therefore the pluperfect *fecisset* is used. *Faveo*, "to favour," governs the dative, not the accusative. There are in Latin a large number of verbs that require this construction.

5. "On hearing that the citizens would remain in Paris or Carthage for a fortnight, he determined to go to Naples at once."

Cum cives Lutetiae vel Carthagine quattuordecim dies mansuros (commoraturos) audivisset Neapolim statim ire statuit.

Notes.—(*a*) "On" and a verbal noun in English are not expressed in Latin by the gerund, but as a rule by *cum* and the pluperfect subjunctive. "On hearing" is equivalent to "when he had heard," *cum audivisset*. (*b*) According to the note given last month, the clause "that.....would remain" will be expressed by the accusative and infinitive, not by *ut* and the subjunctive. The future infinitive will be used, because the action of "remaining" is future to that of "hearing." Note that *mansuros*, not *mansuri*, must be written, because the participle will agree with *cives*, which is accusative masculine plural. (*c*) You can write *civis* instead of *cives*, as in Cicero's time words of the third declension that have the genitive plural in *ium* had the accusative plural in *is*. (*d*) "Place where" is generally expressed by *in* and the ablative. With names of towns and small islands, however, the genitive is used if the noun is a singular one of the first or second declension, otherwise the ablative is used. (*e*) Note that *Neapolis* is one of the words ending in *is* that have the accusative in *im* and the ablative in *i*. (*f*) *Statuo* and *constituo*, "to determine," take the infinitive when the subject of the following verb is *not* different; if it is different, they require *ut* and the subjunctive.

6. "Both the consuls and both of you said that this man would not write this as carefully as possible."

Uterque consul et vestrum uterque hunc hoc quam diligentissime scripturum negaverunt.

Notes.—(*a*) "Both" is expressed by *uterque* and a singular noun—if reference is made to individuals, not to classes—or by *uterque* and the genitive of a pronoun, as in the sentence given above. *Quisque* denotes each, *uterque* refers to two. If *uterque consul* were used by itself, the verb would, of course, be singular, and *negarit* would be written. (*b*) Note in Latin that you are not to write *dico.....non*, but *nego*, to translate "I say that..... not." On the other hand, do not fall into another error, as so many do, and translate "I do not say" by *nego*. A moment's reflection will show you that "I do not say" and "I deny" are not one and the same thing. (*c*) Note the difference between *vestrum* and *vestri*. "Of you" is expressed either by *vestri* or *vestrum*, and *vestri* is used if it depends on a noun or adjective or verb, except when "you" denotes the whole of which a part is taken, as here, where *vestrum* (partitive genitive) is used. The same distinction exists between *nostri* and *nostrum*.

"As.....as possible" is expressed by *quam* and the superlative of the Latin adverb corresponding to the English adverb.

Test Paper.

1. Decline throughout *taetrum volnus, acer canis, terrester* in combination with *sus*.

2. How do the following words differ in meaning in the singular and plural—*facultas, copia, rostrum, ludus, castrum?*

3. When does the accusative plural of words of the third declension end in *is?*

4. Give instances of heteroclite, heterogeneous, and epicene words.

5. Mark the accent in the following words—*relicus, amicus, annotinus, divido, conclamo.*

6. What peculiarities are noticeable in the following words—*supellex, nemo, plerique, ingerum, vas, balneum, rastrum, locus, cir, sestertius, equa, dea?*

7. Compare *frugi, sacer, novus, acer, pulcher, malevolus, pius, aecus*. Mark the quantities of all the vowels.

8. Give the gender, genitive singular, and plural (when found) of *frons, fons, arx, abies, quercus, supellex, ŏs, ōs, nomen, biceps, princeps, anceps.*

Sentences for Practice.

(Readers can have their exercises corrected by sending them to the Editor, Matriculation Course, *P.T.*, and enclosing 7 stamps.)

1. Who has told these wise men why you went to the city of Rome?

2. No one knows what your friend will do to-morrow.

3. We know how (*quomodo*) you dined yesterday.

4. I hope to see your father in Rome to-morrow.

5. Both of the men said that they would not help (*subvenio*) these citizens.

6. Some said that he put this man to death; others that he pretended (*simulo*) to kill him.

7. No one ought to do this, because (*quod*) your uncle is unwilling (*nolo*).

8. All the men will stop in Syracuse for fifteen days.

9. He is not able to say when his father will return to the city.

10. Who threatened to punish him fourteen days ago?

CATILINE—CHAPTERS I. TO VII.

Notes.

Chap. i.

animalibus—dative, governed by *praestare*, meaning "to surpass." In the sense of "to show," or "make good," it governs the accusative.

nobis cum dis commune. We say, "Common to us *and* the gods."

alterum—"one of two."

nostri—objective genitive, depending on *memoriam.*

vine = vi-ne; ne = "whether."

procederet—subjunctive of dependent question.

incipias—the so-called *ideal* subjunctive, where in English we use colloquial "you," equivalent to the French *on.*

mature facto—important use of the ablative of the past participle with *opus. Consulto* is an instance of the same usage.

auxilio—ablative, governed by *eget.*

Chap. ii.

coepere—perfect indicative, third plural.

optimum quemque—"all the best."

voluptati.....oneri—predicative datives.

Chap. iii.

clarum is accusative, agreeing with the subject of the infinitive, which, if expressed, would be in the accusative.

auctorem rerum—"the maker of history."

memores—ideal subjunctive.

The passage from *quae tametsi* to *vexabat* is difficult, and should be known thoroughly.

Chap. iv.

colundo—older form of *colendo.* It is the ablative of the gerund.

officiis—dative, depending on *intentum.*

Chap. v.

vi.....ingenio—ablatives of quality.

patiens inediae—patiens, with the genitive, denotes "capable of enduring;" with the accusative, "actually enduring."

cuiquam—"any one" after a comparative is translated by *quisquam.*

eloquentiae—partitive genitive.

reipublicae capessundae—genitive of the gerundive, depending on *lubido.* Nouns are often followed by the genitive of the gerund or gerundive in answer to the question, "What kind of?" Avoid using the infinitive depending on a noun.

adsequeretur—subjunctive of dependent question.

dum (= "provided that") always requires the subjunctive.

in dies is used to translate "daily" with comparatives and words denoting increase. *Cotidie*, "every day."

quae utraque—"both of which things." You would naturally expect the feminine singular here, as the antecedents are both feminine, and the rule is that the singular of *uterque* is used in reference to two things, the plural in reference to two "sets" or "classes."

domi militaeque—remains of the old locative case.

habuerint—subjunctive of dependent question.

Chap. vi.

Aenea duce—ablative absolute.

postquam—followed, as a rule, by the perfect indicative where we use the pluperfect.

alii alio—lit., "one in one way, another in another"—a very common Latin idiom.

memoratu—supine in *u* is used after certain adjectives. It is either an ablative of respect or the dative in *u.*

quam—"how" before an adjective or adverb is generally translated by *quam.*

coaluerint (*coalesco*)—subjunctive of dependent question.

brevi—"in a short time;" *breviter* = "briefly."

temptare—historical infinitive—a favourite construction of Sallust's. The subject is always in the nominative.

obviam—lit., "in the way of," "to meet"—requires the dative.
dandis—ablative of gerund to express "the means."
consultabant reipublicae—"consulted the interests of the state."
conservandae libertatis. This is a rare usage of the genitive of the gerund or gerundive with the verb "to be," to indicate the tendency or aim. In Silver Age writers—for example, Tacitus—we find it used to indicate "purpose" with other verbs.

(The historical allusions at the end of this chapter are very important.)

binos imperatores—the distributive used to indicate that there were two *imperatores* appointed each year.

Chap. vii.

adepta libertate—note *adepta*, the deponent perfect participle used in a passive sense.

ENGLISH COURSE FOR SEPTEMBER.

1. Grammar.—Adjectives. Nesfield, pp. 25–33, 155–165, 322–330.

Candidates should be able to define an adjective and discuss its definition. In the Matriculation it is scarcely sufficient to give a bare definition. In English especially candidates are apt to err on the side of brevity, thinking perhaps of Shakespeare's well-known aphorism that brevity is the soul of wit. A question often asked is whether the articles should be classified as adjectives, or whether they should be regarded as forming a separate part of speech. The chief argument against regarding them as a separate part of speech is that they have no function that is not performed by adjectives, though, of course, unlike most adjectives, they cannot be used predicatively. Nesfield mentions on p. 29, in a footnote, some cases where the *n* of the indefinite article has glued itself to the following word—for example, *a newt*, *a nickname* = *an ekname* (no connection with old Nick, as old-time etymologists thought), *a nugget*. Note the converse process in *an orange*, *an adder*, etc. Page 30—Note the difference between an *attributive* and a *predicative* adjective; note that only true adjectives can be used attributively. Sec. 96 deals with the substitutes for adjectives. Sec. 97—Candidates are often required to discuss the formation of the comparative and superlative. They should give the usual methods of forming the comparison *er* and *est*, "more" and "most"; state when each is used, and what modifications some words undergo when *er* and *est* are added. Then they should mention the various types of irregular comparison—the formation of comparison (*a*) by vowel changes, (*b*) by different words. They should give instances of double comparatives, of double superlatives, of superlatives formed from comparatives. In secs. 498 to 501, etc., will be found a good account of the formation of irregular comparatives and superlatives. These sections are most important, and should be studied most carefully. Amongst other points may be noted the intrusive "*th*" in farther and farthest; first standing for *forest* (A.S. *fyrst*); *best* contraction for *betst*, formed by mutation from *batista*. Note in 501 the defective comparative *rather*. *Rathe* (= early) is found in Milton—for example, "the rathe primrose." Note in the same section the palatalisation noticeable in *much* (A.S. *micel*). Note on p. 31 the important list of adjectives which do not admit of comparison. A question is often set in Matriculation on this point. You are also often asked to discuss the correctness of phrases such as "more perfect," etc.

The uses of the articles on pp. 159, etc., should be known. "The" is used (*a*) to particularise a noun, (*b*) to change a proper noun into a common noun, (*c*) sometimes to indicate a class or kind; (*d*) occasionally with a common noun to turn it into an abstract noun; (*e*) it is used with names of rivers, mountain ranges, and groups of islands; (*f*) with an adjective it turns it into a noun. "A" is used (*a*) to generalise a noun, (*b*) sometimes in the sense of "one." Note, in sec. 337, when adjectives can be used as nouns. Note "these presents," a literary phrase borrowed from Anglo-French. In secs. 345 and 346 note the correct usages of the comparative and the superlative. Note the Miltonic phrase, "Adam the goodliest of men since born." Note the incorrectness of the phrase, "The largest circulation of any Liberal newspaper," which should be "A larger circulation than that of any other Liberal newspaper." Note in sec. 347 the comparatives, like *major* and *minor*, which have lost their force. The distinctions of meaning between *eldest* and *oldest*, *farther* and *further*, *later* and *latter*, *nearest* and *next*, *outer* and *utter*, *foremost* and *first*, in sec. 348, are very important.

The etymology of the numerals (secs. 493, etc.) is very important. You are often asked to discuss the derivation of the first twenty cardinals, and also to mention those numerals which are not Teutonic in origin. The most important numerals, from an etymological point of view, are—five, nine, ten, eleven, twelve, twenty, score, hundred, thousand, second, third.

Note in sec. 496 the derivation of *such*, *either*, *neither*, *other*, *ilk*, *each*.

2. History.—From the death of King Alfred to the death of William the First.

The lives of the kings who succeeded Alfred should be known, especially those of Edward, Athelstan, Edgar, Ethelred, Canute, and Edward the Confessor. You should be able to give a clear and succinct account of the Danish invasions, and their results upon English life, customs, and language. Among the important men whose lives you should be able to write are Dunstan, Odo, Godwin, and Harold, king of the English. Chapter v. in Gardiner's *History* is a very important one. In it he discusses the conversion of freemen into serfs, the growth of the king's power, the origin of towns and shires, the shiremoot and the witenagemoot. You are often asked to discuss the relations between England and Normandy before the Conquest. Note the origin of Danegelt, ship money, and the massacre of St. Brice's Day. In chap. vi., sec. 21, Gardiner discusses fully the claims of William of Normandy—(1) Edward's selection; (2) support of the Pope; (3) Harold's promises and oath. You should be able to give an account of the battles of Stamford Bridge and Hastings, and draw a plan of the latter battle. You should know the chief Anglo-Saxon institutions. Note what is meant by *boc land* and *folc land*, *methods of trial*, *compurgation* and *ordeal*, *weregild* and *wite*, *sac* and *soc*. It is important to be able to give a detailed account of the causes, progress, and results of the Norman Conquest. We may briefly summarise the results somewhat as follows:—(1) Introduction into England of a foreign dynasty, confiscation of much of the land; (2) a strife of races which lasted for over a couple of centuries; (3) closer connection with the Church of Rome; (4) introduction of greater civilisation, arts and sciences. Note how William the First kept down the Normans by (*a*) the abolition of the great earldoms, (*b*) the scattering of the estates of the great barons, (*c*) by requiring every *sub-tenant* (or tenant *paravail*) to swear fealty to himself as well as to his immediate lord, (*d*) by retaining the national fyrd, (*e*) by his command of money which he obtained from the Jews, whom he introduced into England, (*f*) by the fact that he was the largest landowner himself. He kept the Anglo-Saxons in subjection (*a*) by confiscating their land, (*b*) by building castles, (*c*) by the perfecting of the feudal system. You must be able to give an account of the feudal system, and the chief feudal incidents, which were (*a*) aids, (*b*) reliefs; including primer seisin, (*c*) forfeiture, (*d*) escheats, (*e*) wardship, (*f*) marriages, (*g*) fines.

The English feudal system differed from the Continental system in the fact that every tenant in England swore fealty to the king, and also in the fact that the right of wardship was not known on the Continent except in Normandy. Note the changes which William effected in the ecclesiastical organisation of England. Previously the English Church had been national; ecclesiastical questions had been decided by the shiremoot or witenagemoot. William made the church dependent on himself. A church synod discussed ecclesiastical matters. Gardiner discusses this question very fully and clearly in chap. vii., sec. 7.

The most important men in William's reign whose lives should be known are Odo of Bayeux, Lanfranc, Edwin, Morcar, Edgar Atheling, Waltheof, Stigand, Hereward the Wake. Note the Gemot of Salisbury, the Curfew Bell, Domesday Book, and the New Forest.

MATHEMATICAL AND SCIENCE COURSE.

This month we shall, in place of our ordinary course, give a number of typical or illustrative examples, and shall hold over the solutions to the examples and exercises of our last course until next month.

1. Factorise $1 + x(1 + xy)(1 + y)^2$.

$$1 + x(1 + xy)(1 + y)^2 = 1 + x(1 + y)^2 + x^2y(1 + y)^2$$
$$= y(1 + y)^2x^2 + (1 + y)^2x + 1.$$

By trial, $y(1 + y)x$ and $(1 + y)x$ are the factors of $y(1 + y)^2x^2$.
Hence we try as factors $[y(1 + y)x + 1][(1 + y)x + 1]$.

2. Sum the series $100^2 - 99^2 + 98^2 - 97^2 + \ldots + 2^2 - 1^2$.
By formula, $a^2 - b^2 = (a - b)(a + b)$.

$$100^2 - 99^2 = (100 - 99)(100 + 99) = 100 + 99.$$

Hence the series becomes $100 + 99 + 98 + 97 + \ldots + 2 + 1$

$$= \frac{100}{2}(100 + 1) = 5050.$$

3. Insert two numbers between 2 and 30 so that of the four numbers thus formed the first three shall be in G.P. and the last three in A.P.

Let 2, $2r$, $2r^2$, 30 be the four numbers.
Then $2r$, $2r^2$, and 30 are to be in A.P.

$\therefore 2r^2 = \frac{2r + 30}{2} = r + 15.$

$\therefore 2r^2 - r - 15 = 0.$

$\therefore (r - 3)(2r + 5) = 0.$

$\therefore r = 3$, or $-\frac{5}{2}$.

$\therefore$ the numbers are 2, 6, 18, 30, or 2, -5, $\frac{25}{2}$, 30.

4. A certain quantity lies between 2 and 3; show that by using the mean of 2 and 3 we shall be within 25 per cent. of the true value.

$2\frac{1}{2}$ is the mean of 2 and 3.

Taking 2 as the true value, in place of 2 we use $2\frac{1}{2}$.

$\therefore$ in place of 100 we use 125, so that at the worst we should be 25 per cent. too high.

Taking 3 as the correct value, instead of 3 we use $2\frac{1}{2}$.

$\therefore$ instead of 100 we use $\frac{250}{3}$, or $83\frac{1}{3}$—that is, $16\frac{2}{3}$ per cent. too small.

5. Prove $(b - c)^3 + (c - a)^3 + (a - b)^3 = 3(b - c)(c - a)(a - b)$.

By formula

$x^3 + y^3 + z^3 - 3xyz = (x + y + z)(x^2 + y^2 + z^2 - xy - xz - yz)$,

we get

$$(b - c)^3 + (c - a)^3 + (a - b)^3 - 3(b - c)(c - a)(a - b)$$
$$= [b - c + c - a + a - b][(b - c)^2 + (c - a)^2 + (a - b)^2$$
$$- (b - c)(c - a) - (c - a)(a - b) - (a - b)(b - c)] = 0,$$
since $b - c + c - a + a - b = 0$.

From this the required result readily follows.

Note $x^3 + y^3 + z^3 - 3xyz = (x + y + z)(x^2 + y^2 + z^2 - xy - xz - yz)$
$= \frac{1}{2}(x + y + z)[(y - z)^2 + (z - x)^2 + (x - y)^2]$.

6. Calculate to three decimal places the values of—

$$(a)\ \frac{1}{\sqrt{2}}. \qquad (b)\ \frac{1}{\sqrt{2} + \sqrt{3}}.$$

$$\frac{1}{\sqrt{2}} = \frac{\sqrt{2}}{\sqrt{2} \times \sqrt{2}} = \frac{\sqrt{2}}{2} = \frac{1{\cdot}414}{2} = {\cdot}707.$$

$$\frac{1}{\sqrt{2} + \sqrt{3}} = \frac{\sqrt{3} - \sqrt{2}}{(\sqrt{3} + \sqrt{2})(\sqrt{3} - \sqrt{2})} = \frac{1{\cdot}732 - 1{\cdot}414}{3 - 2}$$
$$= {\cdot}318 \text{ approximately.}$$

7. A body is thrown vertically up, and takes six seconds to reach the ground again. What height did it reach?

Since the time of rising = the time of falling, $\therefore$ each is three seconds.

Now, by formula $s = \frac{1}{2}gt^2$, in three seconds a body would fall 16×9, or 144 feet.

8. Define the unit of force.

The unit of force is that force which, acting on unit mass, would give it unit acceleration. In English units the unit of force is called the poundal, and is that force which, acting on a mass of 1 lb., would give it an acceleration of 1 foot per sec. per sec.

The dyne is that force which would give a mass of 1 gram an acceleration of 1 cm. per sec. per sec.

9. What is an astronomical day?

An astronomical day is the interval of time between two successive northern transits of any fixed star across the meridian. It is subdivided into 24 hours.

10. What is 1° longitude reckoned in time?

The earth turns 360° in 1 day.

$\therefore$ the earth turns 1° in $\frac{1}{360}$ day = 4 minutes.

11. Define specific gravity.

The specific gravity of a substance is the ratio of the weight of any volume of the substance to the weight of an equal volume of the standard substance (usually water at 4° C.).

12. A body, when weighed in air, weighs 20 grams, and when weighed in water, only 16 grams. Find its specific gravity.

By the principle of Archimedes all bodies weigh less in water by the weight of water displaced—that is, by the weight of an equal volume of water—so that

$$\text{specific gravity} = \frac{\text{weight of substance}}{\text{weight of equal volume of water}}$$
$$= \frac{\text{weight of substance in air}}{(\text{weight in air}) - (\text{weight in water})}.$$

By above rule, specific gravity $= \frac{20}{20 - 16} = \frac{20}{4} = 5.$

13. At what rate per cent. will £400 amount to £441 in two years, compound interest being reckoned?

Let the per cent. be such that in one year £1 amounts to £(1 + R), so that £400 in one year becomes £400(1 + R).

This £400(1 + R) in another year will amount to £400(1 + R)^2, so that we get the equation $400(1 + R)^2 = 441$.

$\therefore 20(1 + R) = 21$—that is, $20R = 1$.

$\therefore R = \frac{1}{20}$. $\frac{1}{20}$ of 100 % = 5 %.

$\therefore$ the per cent. is 5.

THE L.L.A. OF ST. ANDREWS:
WHAT IT IS, AND HOW TO GET IT.

The Guinea Stamp.—Universities are springing up on all sides, and university graduates are becoming increasingly common, so that, in the near future, it will be a reproach for the man or woman of culture to be without the guinea stamp of a university diploma; and especially will this be the case with respect to the cultured teacher, whether of the sterner or of the gentler sex. How, then, may women teachers keep pace with the times? It is our opinion, founded upon much experience, that the woman of intelligence, as opposed to genius, who would fain obtain the coveted distinction without giving up herself entirely to the demon of study, whose devotee must scorn delights and live laborious days in the pursuit of lean and wasteful learning, will do well to turn her eyes in the direction of the ancient city of St. Andrews, whose university has devised a scheme whereby a studious woman may pleasantly and rationally obtain a university degree which stands high in the esteem of the world of culture—namely, the title and diploma of Lady Licentiate in Arts of St. Andrews University. The value of the degree is apparent from the fact that candidates enter for the qualifying examinations from all parts of the world, and not only from the English-speaking part of it. A diploma thus widely sought after must have peculiar value; and we believe that the great charm of the course in the eyes of women is the liberty allowed both with respect to time and to subjects.

The Subjects.—These are divided into four departments, which, together with the individual subjects comprised by each, we give below.

1. The Department of Language, including Latin, Greek, English (with Anglo-Saxon), French, German, Italian, Hebrew, Comparative Philology.

2. The Department of Philosophy, including Logic, Moral Philosophy, Political Economy, Æsthetics, Political Science, Comparative Religion.

3. The Department of Science, including Mathematics, Natural Philosophy, Chemistry, Astronomy, Geology, Physiology, Zoology, Botany.

4. Miscellaneous Department, including Education, History (Ancient and Modern), Theology, Biblical Criticism, Biblical History and Literature, Church History, Fine Art, Music, Geography, Hygiene.

In every subject there is a Pass and an Honours division, each with its own separate syllabus—a success in Honours being equivalent to two successes in the Pass division of a subject; and, as the student must register **seven successes** before being entitled to the standing of an L.L.A., it follows that she must, in order to qualify, secure seven passes, five passes and one honours, three passes and two honours, or one pass and three honours—four being the minimum number of subjects that can be taken; and it must be carefully noted that at least **one subject must be taken from each of the departments of Language, Philosophy, and Science,** the remaining subject or subjects being taken at will out of any one or more of the departments.

Books.—A very good feature of the L.L.A. examination is its definiteness. Special books are named as covering the various subjects, and the student may rest assured that the questions set will bear directly upon the books named, so that she who has honestly and intelligently mastered the contents of the books set out in the syllabus will have no need to fear the examiner when June comes round—the month of roses being also the month of L.L.A. examinations.

Preliminary Certificate.—Before being allowed to sit at any L.L.A. examination, the would-be candidate must have passed some examination sufficiently advanced to guarantee

a fair level of general culture. A Government teacher's certificate or even the Queen's Scholarship examination is accepted as satisfactory under this head, so that we may dismiss any further consideration of the preliminary certificate.

How the Subjects may be taken.—The university leaves this entirely to the option of the student, who may take as few as one or as many as seven subjects in one year, *provided the times set apart for the examinations do not clash*, which the student is directed to ascertain by referring to the time-table before notifying the secretary—the only penalty for delay being a little additional expense, as the fee to be paid by the student coming up for the first time is two guineas, which covers two examinations whether consecutive or no. At a third and each subsequent examination a further fee of one guinea must be paid.

The Ideal Course.—This will manifestly depend to a great extent upon the previous work and predilection of individual candidates; but for those who desire a course useful to a teacher, and not making very excessive demands upon her, we suggest as follows:—

(*a*) The Department of Language—English (Honours) or French (Honours).

(*b*) The Department of Philosophy—Logic (Pass) or Political Economy (Pass).

(*c*) The Department of Science—Geology (Pass) or Chemistry (Pass).

(*d*) The Miscellaneous Department—Education (Honours), History (Pass or Honours), Geography (Honours).

From these subjects three Honours and two Pass subjects should be selected. Of these, Education and English should certainly be Honours subjects, the rest being left to the individual choice of the student.

Value of the Diploma.—After the qualifying examinations have been passed, an additional fee of four guineas has to be paid before the diploma can be received, or the academic costume, consisting of cap, gown, and academic badge in the form of a sash, can be worn. The diploma is accepted by the Board of Education, and also by the University of Paris—the former accepting it as equivalent to the Government certificate, the latter receiving it as equivalent to the *brevet supérieur* for admission to the Sorbonne examination for the *Certificat d'aptitude à l'enseignement des langues vivantes*.

"The Practical Teacher" and the L.L.A.

A proposed Preparative Course.

Preparative courses have been given in The Practical Teacher from time to time to assist candidates in their efforts to obtain the coveted distinction. Obviously we cannot cover the whole of the subjects, hence we have to look for guidance to our lady readers as to what we shall do for them in connection with the L.L.A. We therefore appeal to all who wish for help to send a post-card to the Editor, Practical Teacher, 36 Paternoster Row, stating exactly what they would like. In order that they may know exactly what the requirements are, we suggest that they should at once write to the Secretary, L.L.A. Scheme, St. Andrews University, Scotland, asking for a syllabus, which will be sent to them post free; or they may prefer to get the *Calendar*, which is published by Messrs. Blackwood and Sons, Edinburgh, at 1s., and which contains a list of successful candidates, examination papers, and syllabus.

We should like it to be distinctly understood that our future action will depend entirely upon the number of requests for help received by the Editor. If there are but few letters, there will be no L.L.A. course whatsoever; whilst, on the other hand, there will be an L.L.A. course, commencing in our next number, in every subject for which a considerable number of requests are received.

The matter being thus in the hands of our lady readers, we trust they will decide it promptly and definitely, bearing in mind that if we do not commence an L.L.A. course in our October number, no course will be started until the corresponding period of 1901.

QUERY COLUMN.

RULES.

1. Each correspondent is restricted to *one* question.
2. Each query must be accompanied by the name and address of the correspondent, and the *coupon* which appears on the back wrapper of the current number of the Journal.
3. Correspondents must in all cases state the source from which their query has been obtained.

The Editor reserves to himself the right to decline to answer any question which is, in his judgment, unsuited to the Magazine.

J. C. Mackenzie.—Bisect a triangle by a straight line drawn through any point *without* it.

We have not been successful, so far, in obtaining a construction the proof for which can be made to depend on the First Book of Euclid. In practical geometry it is a well-known problem, but it is not regarded as an elementary one. A construction may be found in several text-books—for example, Angels's *Practical Plane and Solid Geometry*—but the proof requires the Sixth Book. Perhaps some reader of this journal may be able to furnish a simple construction admitting of an easy proof. The author of the text-book from which the example is taken may know of a solution.

Bike.—Show that $PA^2 \sin A + PB^2 \sin B + PC^2 \sin C$ is a minimum when P is at the incentre.

(*Differential Calculus*, J. Edwards, p. 195.)

Let B be the origin of co ordinates, BC the axis of x, $(h\ k)$ the co-ordinates of A, and $(x\ y)$ those of P. Then it is evident from a figure that

$$PA^2 \sin A = [(x-h)^2 + (y-k)^2] \sin A,$$
$$PB^2 \sin B = (x^2 + y^2) \sin B,$$
$$PC^2 \sin C = [(x-a)^2 + y^2] \sin C.$$

Then, observing that

$$h = c \cos B,\ k = c \sin B,$$

$PA^2 \sin A + PB^2 \sin B + PC^2 \sin C = (x^2 + y^2)(\sin A + \sin B + \sin C) - 2x(c \sin A \cos B + a \sin C) - 2y(c \sin B \sin A) + a^2 + c^2.$

Putting this in the form

$$(x-d)^2 + (y-e)^2 + \text{constant},$$

the given expression becomes—

$$\left\{x - \frac{c \sin A (1 + \cos B)}{\sin A + \sin B + \sin C}\right\}^2 + \left\{y - \frac{c \sin B \cdot \sin A}{\sin A + \sin B + \sin C}\right\}^2 + \text{constant}.$$

This is a minimum when each of the squares is zero—that is, when

$$x = \frac{c \sin A (1 + \cos B)}{\sin A + \sin B + \sin C}, \quad y = \frac{c \sin B \cdot \sin A}{\sin A + \sin B + \sin C}$$

Now these values are—

$$x = \frac{2c \sin \frac{A}{2} \cdot \cos \frac{A}{2} \cdot 2\cos^2 \frac{B}{2}}{4 \cos \frac{A}{2} \cdot \cos \frac{B}{2} \cdot \cos \frac{C}{2}}$$

$$= \frac{c \sin \frac{A}{2} \cdot \cos \frac{B}{2}}{\cos \frac{C}{2}} = s - b,$$

$$y = \frac{2c \sin \frac{B}{2} \cdot \cos \frac{B}{2} \cdot \sin \frac{A}{2} \cdot \cos \frac{A}{2}}{4 \cos \frac{A}{2} \cdot \cos \frac{B}{2} \cdot \cos \frac{C}{2}}$$

$$= \frac{c \sin \frac{A}{2} \cdot \sin \frac{B}{2}}{\cos \frac{C}{2}} = \frac{S}{s} = r.$$

(For if $A + B + C = \pi$,

$$\sin A + \sin B + \sin C = 4 \cos \frac{A}{2} \cdot \cos \frac{B}{2} \cdot \cos \frac{C}{2}.$$

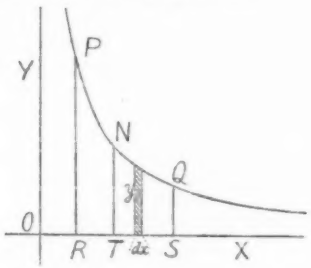
See any text-book of trigonometry.)

But $(s - b, r)$ are the co-ordinates of the incentre, because the tangent from B to the incircle is $s - b$.

Barcoo (Queensland).—A new book of Object Lessons on the subject you mention is in the press, and will be published by T. Nelson and Sons.

Bike.—A rectangular hyperbola, whose transverse axis is $2a$, revolves about an asymptote, and the surface generated is cut by two planes perpendicular to that asymptote. If A and A^1 be the areas of the plane sections, find the volume of the space included between them and the surface. Divide this volume into two equal parts by a plane perpendicular to the axis of revolution. (Science and Art, Stage V., 1900.)

Let PNQ be one branch of the hyperbola, RP and SQ those radii which generate the sections A and A^1 when PNQ revolves about the asymptote OX.



The equation to PNQ is

$$xy = \frac{a^2}{2}$$

when referred to OX and OY as axes.

Since $\pi PR^2 = A$, and $\pi SQ^2 = A'$,

$PR = \sqrt{A \div \pi}$, and $SQ = \sqrt{A' \div \pi}$.

Also, $OR \cdot RP = \frac{a^2}{2}$, and $OS \cdot SQ = \frac{a^2}{2}$.

$$\therefore OR = \frac{a^2}{2}\sqrt{\frac{\pi}{A}}, \text{ and } \quad OS = \frac{a^2}{2}\sqrt{\frac{\pi}{A'}}.$$

During the revolution about OX, the shaded area generates a short cylinder whose volume is

$$\pi y^2 dx; \text{ that is, } \pi \frac{a^4}{4}\frac{1}{x^2}dx.$$

Therefore the required volume is—

$$\int_{OR}^{OS} \pi \frac{a^4}{4}\frac{1}{x^2}\,dx; \text{ that is, } \frac{\pi a^4}{4}\left(-\frac{1}{x}\right)_{OR}^{OS}$$

$$= \frac{\pi a^4}{4}\left(-\frac{1}{OS} + \frac{1}{OR}\right) = \frac{\pi a^4}{4}\frac{2}{a^2}\left(\sqrt{\frac{A}{\pi}} - \sqrt{\frac{A'}{\pi}}\right)$$

$$= \sqrt{\pi}\frac{a^2}{2}\left(\sqrt{A} - \sqrt{A'}\right).$$

Now let OT be such that the volume generated by RPNT is half that generated by RPQS, then volume generated by RPNT is, from the above,

$$\sqrt{\pi}\frac{a^2}{2}\left(\sqrt{A} - \sqrt{A''}\right),$$

where $$A'' = \pi TN^2 = \frac{\pi a^4}{4}\frac{1}{OT^2},$$

and therefore $$\sqrt{A''} = \sqrt{\pi}\frac{a^2}{2}\frac{1}{OT}.$$

Hence, from the data,

$$\sqrt{\pi}\frac{a^2}{2}\left(\sqrt{A} - \sqrt{A'}\right) = 2\sqrt{\pi}\frac{a^2}{2}\left(\sqrt{A} - \sqrt{A''}\right),$$

or, $$2\sqrt{A''} = \sqrt{A} + \sqrt{A'}.$$

$$\therefore \sqrt{\pi}a^2\frac{1}{OT} = \sqrt{A} + \sqrt{A'}.$$

$$\therefore OT = \sqrt{\pi}a^2 \div (\sqrt{A} + \sqrt{A'}).$$

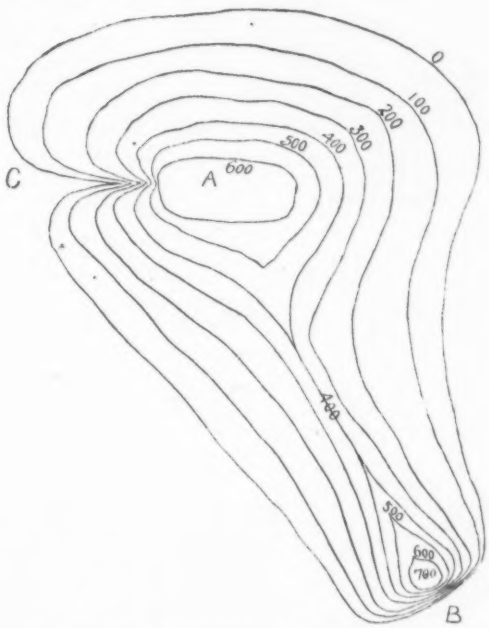
—— A ridge, 400 feet high, connects a broad-topped hill, whose height is 600 feet, with a conical peak, 700 feet high, situated to the south-east of the hill. The hill is indented on its west side by a steep ravine, but its other sides are of gentle declivity. The side of the peak which faces the hill is of more gradual slope than its other sides, which are steep, the south-east side being precipitous.

Express these relations by means of a map with contour lines, marking intervals of 100 feet vertical heights.

(Oxford Local Junior, 1899.)

The figure shows a portion of country possessing the features referred to in the given description. In considering this most valuable form of example, it is only necessary to understand clearly what a contour line means, and then to imagine the form of the surface of the country to be considered.

From A towards B is supposed to be south-east; from A towards C is west.

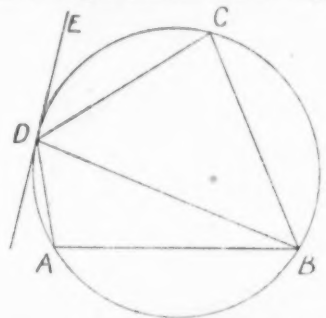


A person, who to a man in a balloon above this country appears to be walking on the line marked 200, will neither ascend nor descend, but will always be walking *horizontally*, and at a height of 200 feet. Following the path of this person as he moves round the hill westwards towards C, we observe that he has to turn nearly eastwards in order to get to the other side of the ravine or gully, then nearly westwards again. The contour lines shown crowded together near B indicate the precipitous nature of the ground in that neighbourhood. But no description is really necessary if the reader understands what a contour line indicates.

Variable.—The opposite angles of a cyclic quadrilateral are supplementary. What does this proposition become in the limit when two angular points coincide?

(*Differential Calculus for Beginners*, Ex. i., No. 6.)

Let ABCD be the quadrilateral. The given proposition states that the angles CDA and CBA are supplementary.



Now suppose A, B, D to remain fixed, and C to travel *along the circumference* towards D; when C is just running into D, the line joining them becomes the tangent ED. Hence, since ED is a particular position of CD, the angle EDA is supplementary to DBA (remember that C is now indefinitely close to D), and hence the angle EDB is equal to the angle DAB, which is what is proved in III. 32.

Bene, A. W., Burns, E. J. Browne.—Queries received too late for our September number. Solutions will appear in October.

OUR SCIENCE SECTION

☞ **Subscribers requiring Explanations of Difficulties in any branch of Science, or Advice upon Courses of Study, can obtain all help required by communicating with the Editor, and accompanying their query with the Coupon cut from this Number.**

STAR STUDY
FOR SCHOLARSHIP STUDENTS.

X.—SEPTEMBER.

THE constellations with which we have made acquaintance are, during September, to be found as follows:—

In the **Zenith**, Cygnus, Lyra, and Cepheus are the groups to be noticed.

The **North** displays Ursa Minor, Auriga represented most worthily by Capella to the north-east, Perseus, and Cassiopeia.

The **East** is resplendent with Gemini, Taurus, Aries, Andromeda, and Pegasus.

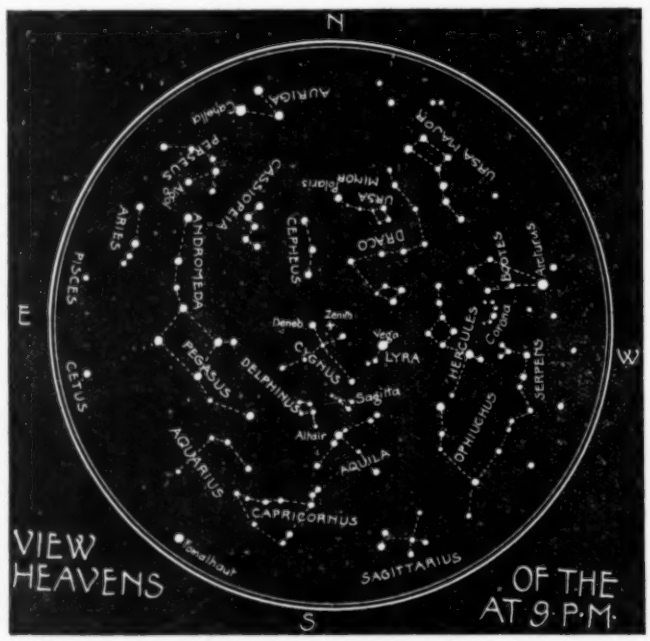
In the **South** shine Aquila, Sagittarius, Capricornus, and Libra.

The **West** is bright with Hercules, Corona, Boötes, and Virgo.

Planets.—**Venus** is a morning star. She rises, in the middle of the month, a little more than four hours before the sun. On the 17th she attains her greatest western elongation. She is in the constellation Cancer, and on the 19th will be found near the moon.

Saturn is visible from sunset till about 10 p.m., his time of setting in the middle of the month being about half-past ten. He is in the constellation Sagittarius. On September 3 he is occulted by the moon from 7.16 p.m. to 8.11 p.m.

Jupiter is an evening star in Scorpio, setting about two hours after the sun, his time of setting in the middle of the month being three or four minutes before nine. On the 1st, and again on the 29th, he is in close proximity to the moon.



STAR MAP NO. X. (SEPTEMBER).

Mars is in Gemini, but does not rise until about midnight, his exact time of rising in the middle of the month being ten minutes after midnight.

Mercury is invisible. He is in the group Virgo, and on the 13th is in superior conjunction with the sun.

The day, which has been shortening since the summer solstice, again becomes equal in duration with the night on the 23rd of September, this being the date of the **autumnal equinox.** The day is 13 hours 33 minutes long at the commencement of the month, but only 11 hours 41 minutes on the 30th.

This variation in the length of day and night should be well understood by the student, who should be able to draw the diagram given on page 143 of Gregory's *Elementary Physiography* (Nelson and Sons), and to explain why rotation and revolution of the earth, coupled with the obliquity of the earth's axis, cause this variation in the length of day and night, and also give rise to the seasons. Rotation alone is capable, it is true, of causing daylight to succeed darkness; but if the earth's axis were not inclined from the perpendicular, the circle of illumination would pass through the poles, and day and night would be equal throughout the year. But the earth's axis is inclined 23½° from the vertical, and what the student must understand is the effect of this obliquity of the axis in causing the circle of illumination to cut the parallels of latitude unequally, excepting the equator, which is always bisected. For example, in northern summer, at the summer solstice—namely, on June 22—the sun is vertical over the tropic of Cancer, and we have very short nights and very long days. The circle of illumination takes in the whole of the Arctic circle and excludes the whole of the Antarctic circle, so that there is no night in Arctic regions and no day in Antarctic regions. In six months' time—namely, at the winter solstice on December 22—this condition of affairs is reversed, the sun being vertical over the tropic of Capricorn, and the whole of the Antarctic circle being included within, and the whole of the Arctic circle being excluded from, the circle of illumination. A study of the diagram already alluded to will make this clear. Now let us consider the state of affairs at the equinoxes. The axis of the earth is neither inclined towards nor from the sun, which is now vertical to the equator, and the circle of illumination passes through the poles, and bisects every parallel of latitude, including the Arctic and Antarctic circles. Hence the whole of the earth has twelve hours' darkness and twelve hours' daylight for every rotation of the earth on its axis.

The Sun's Apparent Path in the Sky.—The obliquity of the earth's axis has a very important effect upon the apparent path of the sun in the heavens, which the Scholarship student must be well acquainted with. This we will consider as it appears to an observer (*a*) at the poles, (*b*) at the equator, and (*c*) in middle latitudes.

(*a*) **At the Poles.**—At the equinoxes the sun will describe a circle coincident with the horizon—that is, his altitude will be 0°. At the summer solstice his path will be a circle parallel to the horizon, but 23½° above; whilst at the winter solstice his path will be a circle 23½° below the horizon—that is, he will not be visible at all. Hence there is a difference of 47° here, as everywhere else on the earth, between the summer and the winter altitude of the sun.

(*b*) **At the Equator.**—At the equinoxes the sun will rise exactly in the east, culminate exactly in the zenith, and set

exactly in the west. At the summer solstice the sun's path will commence from a point 23½° to the north of west, he will culminate at a point in the sky 23½° to the north of the zenith—that is, in the south—and set 23½° to the north of the west point. Substituting south for north, the above explanation applies to the path of the sun in the heavens at the winter solstice.

(*c*) **In Middle Latitudes**—say 51½° N. (latitude of London).—At the equinoxes, when the sun is vertical over the equator, his altitude at 51½° N. is 90 – 51½° = 38½°—that is, he rises exactly in the east, culminates at a point 51½° to the south of the zenith, and sets exactly in the west. At the summer solstice the sun's altitude will be 38½ + 23½ = 62°, and at the winter solstice his altitude will be 38½ – 23½ = 15°. Again, at the equinoxes the sun will rise and set exactly due east and due west; but at other times he will rise and set a certain number of degrees to the north of east or west according to the latitude, being 23½° at the equator at the solstices, as already said, and 90° at the poles, and anything between these two limits in middle latitudes, the amplitude, as it is called, being greatest in higher and least in lower latitudes.

NOTES ON PHYSIOLOGY.

ADVANCED AND HONOURS: BOARD OF EDUCATION.

BY WALKER OVEREND, M.A., M.D. (OXON.), B.SC. (LONDON),

Late Senior Physician to the Tottenham Hospital; Radcliffe Fellow, Scholar of Balliol College, and Exhibitioner in Comparative Anatomy of the London University.

Books Recommended.

In the teaching of physiology, the Science and Art Department for many years have insisted on the value of *practical instruction*. The fact has been emphasised repeatedly that book-knowledge is comparatively valueless unless it is supplemented by the examination of specimens and the practice of dissection. Professor Huxley's instructions to teachers of elementary and advanced physiology should be carefully read. Moreover, he further said: "Practical teaching needs to be brought home to the learner. The examiners are so frequently told, 'I have seen this or that,' when it is quite obvious that the seeing might as well have been performed with the eyes shut, that they think it well to remark that, without understanding there is no more virtue in seeing than in not seeing." The teacher must therefore see that the students attend to the demonstration. They must be examined upon, and, if possible, made to go over it. For advanced classes practical teaching is even more important. In the Honours there are two parts—a written and a practical examination. In the latter, which can only be taken after a pass in Part I., an accurate knowledge of practical histology is required, and particularly of fresh preparations—such as nerve, muscle, connective tissue; also the student may be called upon to demonstrate the properties of the chief physiological fluids—as blood, bile, urine, milk, etc. Moreover, he must be thoroughly acquainted with the properties of muscle and nerve, and be able to demonstrate such facts as the independent excitability of muscular tissue, and may be called upon to determine the latent period of the gastrocnemius muscle in the frog. For this examination the student must enter a class of practical physiology. He should make notes of each experiment, and make sketches of the apparatus required. He should thoroughly understand the induction coil, the effects of induced currents, and of the constant current.

The books which can be recommended for the elementary stage are—*Physiology for Beginners*, by M. Foster and Lewis A. Shore, 1897 (Macmillan and Co.), and *Elementary Physiology*, by Benjamin Moore, M.A., published by Longmans, Green, and Co., 1899. The latter contains an appendix of practical exercises which should be carefully worked through; or the teacher should demonstrate each to the class. But every member of the class should, at an early period of the lectures, dissect an animal—a rabbit or large rat, and a frog—systematically, and note the position of all the important organs. He should dissect out the largest nerves, as the sciatic, the phrenic, and the vagus. Plenty of time should be devoted to it, and the dissection repeated more than once. Pilley's *Practical Physiology*, published by George Gill and Sons, may be found useful by the students. For the advanced stage, the most generally useful book is Kirke's *Handbook of Physiology*, new edition, edited by Professor Halliburton, and published by J. Murray. Dr. Yeo's *Manual of Physiology*, published by Churchill, may also be recommended. For the practical work, Professor Schäfer has published a handy book, *The Essentials of Histology* (Longmans). Professor Halliburton's *Essentials of Physiological Chemistry* may be used for the chemical part; and for the experimental physiology, Brodie's *Essentials of Experimental Physiology*, published by Longmans. In addition to these books, the candidate for Honours should acquire a special knowledge of the brain, nervous system, and the senses, and may consult Michael Foster's *Text-Book of Physiology, Part III.*, entitled "The Central Nervous System." This is published by Macmillan.

In the teaching of histology, the student will find himself amply repaid by studying the tissues in the simple state. Fine pieces of connective tissue are taken from a freshly-killed rabbit, spread out under a cover-slip, and stained with logwood. If a little dilute acetic acid be run under the cover-slip previously, the connective tissue cells come out very clearly. Other objects are—(1) the white and red corpuscles of the frog and rabbit, and the influence of reagents, weak alcohol, iodised serum, tannic acid (also the white corpuscles may be fed with particles of vermilion); (2) the cells of red marrow; (3) muscle and tendon in fresh state; (4) nerve fibres stained with silver nitrate, osmic acid, and chloride of gold; (5) columnar and ciliated epithelium, etc. As further exercises, the hardening, staining, and preparation of thin sections of various organs—as stomach, duodenum, salivary glands, liver, kidney, spinal cord, cerebrum, and cerebellum—may be mentioned. The course of practical chemistry should embrace—(1) the blood and its coagulation; (2) the properties of proteids, blood serum, and the action of gastric juice and pancreatic juice on proteids; (3) the properties of oxyhæmoglobin, its spectrum, and the properties of hæmatin, etc.; (4) the constituents of milk, urine, and bile should be demonstrated: the student should prepare casein and milk sugar from milk, as well as urea and uric acid from urine; (5) the properties of myosin of fresh muscle.

The student should learn to make a nerve-muscle preparation (sciatic and gastrocnemius) in the frog, and to arrange the nerve and muscle separately for stimulation, and arrange a lever for registering the effect on a travelling surface previously blacked. He should understand the properties of curarised muscles, and the meaning of tetanus and voluntary tetanus. He should be able to demonstrate the effect of stimulating the vagus in the frog.

Certain instruments, as the sphygmograph, cardiograph, etc., should be explained to him.

ELECTRICITY AND MAGNETISM.

NOTES ON ADVANCED AND HONOURS STAGE.

BY EDWIN EDSER, A.R.C.S., F.PH.S.

In starting the year's work in science, it is important that the student should provide himself with the best book obtainable. The number of books on the market renders the selection a matter of some difficulty, especially as a book which may be excellent for one class of students may prove next to valueless to another class.

The standard set up by examiners of the Board of Education is somewhat high, and requires very definite knowledge from the student, especially in the subject of electricity and magnetism.

It is well for the student to at once recognise that this standard cannot be fully attained as the result of merely reading a book, however good that may be, or of attending lectures, even those of the most competent teacher. Individual effort is absolutely necessary. The student is required to master a certain number of laws, and having done so, he must qualify himself to make deductions from these laws, and to rapidly work out numerical examples. It is perhaps in this last particular that the average student finds the greatest difficulty. In the first and second stages no considerable amount of mathematical skill is required, but the student must learn at the outset to reason by means of symbols.

If our system of mathematical education were better, this difficulty would not exist; but, unfortunately, far too much time is generally spent, at the outset of a student's career, in the mastery of analytical difficulties of a somewhat advanced order, whilst the application of mathematics as an aid to exact reasoning in physical science is to a great extent neglected. It would be well if every student taking up the study of electricity (at any rate for the advanced stage) should simultaneously qualify himself in the subject of practical mathematics lately organised by Professor Perry, F.R.S., of the Royal College of Science.

Mr. Castle's book on the subject (Macmillan and Co.) may be consulted with advantage. The student who pursues this course will, as a result of a trifling expenditure of labour, save himself much subsequent disappointment.

The student who wishes to attain to exactness by means of writing can hardly do better than answer questions set in past years by the Science and Art Department. Complete questions in the elementary and advanced stages for the last ten years can be obtained from Mr. A. T. Burgess, of Peckham.

Conference Classes.—Teachers who will take the trouble to organise a conference class, in addition to the ordinary lectures, will be surprised at the improvement thus effected in the status of the students; and with the exercise of a little tact, such classes will be found to greatly increase the interest taken in their studies by the students, and thus to solve the often difficult problem of keeping a class together. The chief difficulty is to encourage the students to express their opinions freely. To do this, the teacher should sink the pedagogue as far as possible, and try to impress his students with the fact that he too is a student, and that he is not, on occasion, above learning from members of his class. Some such rules as the following may be suggested:—

1. Any problem connected with the subject can be proposed by any student.

2. The students themselves should, as far as possible, solve such problems.

3. As a foundation for debate, the experiments of accepted authorities should be received as final, unless any valid objection as to the manner in which these experiments were carried out can be raised.

4. Any student shall be at liberty to formulate any inference which he considers can be deduced from such experiments, on the principle that science consists of common sense inferences deduced from experimental data.

5. Students should be encouraged to suggest simple experiments to solve any difficulties that may arise, and the apparatus at the disposal of the teacher should be freely used for this purpose by the students.

In following out a plan such as the above, a living interest will be sustained in the students to an extent unattainable by other means. Most large teaching institutions possess a debating society; and it will not be found impossible to convince students that the discussion of a scientific problem may possess as much interest as a debate on "Hats," or "The Position of the Boers in Africa."

Suggestions from any teacher wishing to organise classes upon the above lines will be gladly received by the author of these notes, and discussed in THE PRACTICAL TEACHER as occasion arises.

Books Recommended.

Elementary Stage.—*Magnetism and Electricity for Beginners*, by H. E. Hadley, B.Sc. (Macmillan and Co.). This little book cannot be too highly recommended. It is well printed, arranged excellently, and is rendered attractive by 197 illustrations, mostly original, and many reproductions of photographs. Points on which stress is laid by the examiner are specially considered, and care has been taken that the student should have an opportunity of building up precise knowledge of the laws of the science.

A number of simple experiments which may readily be performed by the students are included in the text, and a short summary is given at the conclusion of each chapter; numerous examples are given, and a useful index is provided. Elementary students cannot do better than use this book.

Advanced Stage.—There is at present no book which deals with the advanced stage in a manner as satisfactory as the above work deals with the elementary stage. Perhaps the most satisfactory book is *Magnetism and Electricity*, by Arthur William Poyser, M.A. (Longmans). The chief fault to be found with this work is that Faraday's conception of lines of force is not used sufficiently systematically in the development of electrostatics. Advanced students would do well to supplement the knowledge gained from this work from the opening chapters of Professor J. J. Thomson's *Elements of Electricity and Magnetism*. Students possessing back numbers of THE PRACTICAL TEACHER will in those find many useful notes, together with the solutions of problems possessing difficulties to the ordinary student. Students or teachers wishing for solutions of problems of exceptional difficulty are invited to send these to the editor of the Query Column.

Honours Stage—Part I.—The best book for students preparing for the examination in this stage is Professor J. J. Thomson's *Elements of Electricity and Magnetism*. There is no book, however, which entirely covers the subject, since the student is required to be familiar with the most modern developments of the science. Much useful information may be obtained from *Science Abstracts* (E. and F. N. Spon, Limited). Mr. E. E. Fournier d'Albe's excellent abstracts of "Contemporary Electrical Science," appearing weekly in *The Electrician*, may also be consulted with advantage.

A knowledge of the higher mathematics is not specifically required for this stage, but an elementary knowledge of the differential and integral calculus will prove very useful. An elementary work of the latter branches of mathematics will shortly be published at a low cost by T. Nelson and Sons.

To understand the thermo-electric diagrams, some knowledge of thermo-dynamics is requisite; this subject is treated of in a manner easily understood by the average student in *Heat for Advanced Students*, by Edwin Edser (Macmillan and Co.).

Honours Stage—Part II.—To qualify for the examination in this stage, the student is required to possess a very complete acquaintance with the present state of the science of electricity and magnetism. Maxwell's *Electricity* (Clarendon Press), 2 vols., is the standard work, but is likely to present considerable difficulties to the average student. Mascart and Joubert's *Electricity* may be recommended as an introduction, also *An Introduction to the Mathematical Theory of Electricity and Magnetism*, by W. T. A. Emtage, M.A. (Clarendon Press). Webster's *Electricity and Magnetism* is also a most useful book, as it possesses a comparatively complete introduction to the mathematics required. Much useful information may also be found in the first volume of Fleming's *Alternate Current Transformers* (Electrician Publishing Company, Salisbury Court, Fleet Street).

The experimental aspect of this subject is well treated of in Stewart and Gee's *Practical Physics*.

CHEMISTRY NOTES.

BY THOMAS CARTWRIGHT, B.A., B.SC. (LOND.),
First Class Honourman in Chemistry.

Composition of Soot from Mineral Coal.—The value of coal soot as a fertiliser has impelled Dr. Warth of Birmingham to make the following examination. He took 368 grams of soot from a chimney, and extracted the soluble matter by boiling with water, filtered, and evaporated. He sublimed the residue from evaporation, in order to obtain the ammonium salts separately as sublimate. The remainder was lixiviated, in order to obtain the soluble non-volatile salts separated from carbon. The following figures represent the composition:—

	Percentage of Salts from the Original Soot.
Ammonium sulphate	0·1
Ammonium chloride	7·3
Total ammonium salts	7·4
Total soluble fixed salts	1·3

These fixed salts consisted of sulphates and chlorides of sodium, magnesium, calcium, and iron. The fixed salts contained much more sulphate than chloride. It is to be observed that the proportion of ammonium salt quite justifies the estimation in which the soot is held as a manure.

Action of Oxidising Agents on Alkaline Iodides.—Periodate of sodium ($NaIO_4$) is an energetic oxidising agent capable of reacting on alkaline iodides. Using this reagent, M. E. Péchard shows that the decomposition takes place in the cold, and that it is represented by the following equation:—

$$3NaIO_4 + 2NaI + 3H_2O = NaIO_3 + 2Na_2H_3IO_6 + I_2.$$

The reaction is not complete until after the expiration of an hour, when the quantity of iodine liberated is in accordance with the above equation. Similar results were obtained by employing ozone or hydrogen peroxide as the oxidising agents, and potassium iodide as the alkaline iodide.

Selenides of Iron.—M. Fonzes-Diacon, whose work in the preparation of the selenides of manganese has already been referred to in these notes, has turned his attention to the preparation of the selenious compounds of iron, with the result that he has proved the existence of the following bodies—$FeSe_2$, Fe_2Se_3, Fe_3Se_4, Fe_7Se_8, and FeSe, corresponding to the well-known sulphides of iron. He was unable to obtain the compound Fe_2Se by the reduction at a high temperature of iron selenides, this action giving only a mixture of iron and FeSe.

Heat of Dissolution of H_2O_2.—M. de Forerand, arguing from the fact that it is just possible to obtain H_2O_2 almost in the anhydrous state by distillation under very reduced pressure, infers that if the heat of dissolution of anhydrous H_2O_2 is positive

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it is very slight, and proceeds to measure this slight heat of dissolution, which he finds to be +0·460 cal.

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Radium, or Radio-Active Barium?—Professor von Lengyel of Budapest has been studying the question as to whether the highly radio-active body obtained from pitchblende is a new element, or simply a radio-active variety of barium. He draws attention to the fact that radio-active bodies have been obtained from five different sources—namely, the compounds of uranium, thorium, polonium, radium, and a substance resembling titanium that was brought to light by Debierne. Uranium and thorium have long been known to be well-defined elements; whereas the last named three bodies are only hypothetical elements, of which radium is by far the best known, the evidence of its elemental nature being that it has a higher atomic weight and a different spectrum from barium. It was to determine whether or not radio-active barium could be prepared from ordinary barium compounds that Professor Lengyel set to work; and as he succeeded in his efforts, it is almost absolutely certain that the so-called element radium is nothing but a special form of barium. For the preparation of radio-active barium sulphate, the professor recommends that uranyl nitrate be melted together with two or three per cent. barium nitrate, the nitric acid being, as far as possible, driven off by sustained heating, followed by fusing in the electric arc. The fused mass is dissolved in nitric acid and the solution evaporated, by which means a large proportion of the baryta separates as nitrate. The hot solution is decanted from the crystals, diluted with three or four times its volume of water, and the radio-active barium sulphate is precipitated with sulphuric acid.

The precipitate, when well washed with water, dried, and heated, is white with a tinge of yellow, perhaps due to a trace of uranium.

Tests of Radio-Activity.—The substance was put into a little glass vessel, the bottom of which showed a faint gleam of light, and the glass was placed on a sensitive photographic plate wrapped in black paper. After two hours the plate was developed, and a strong black mark appeared corresponding to the transverse section of the glass. Radium rays are said to penetrate thin metal sheets; the radio-active barium sulphate did the same. One half of a copper coin was ground down to about one-third the thickness of the other half. The coin was laid between the vessel containing the barium sulphate and the sensitive plate wrapped in black paper, and left there for three hours. After development, the plate was found to have remained white on the spot corresponding to the thicker copper layer, and had become grey beneath the thinner copper layer. In like manner, the barium sulphate prepared as above illuminated a platino-cyanide screen just as does the supposed element radium, the only difference being one of degree, the sulphate illumination proving less than that of the radium.

Other Compounds.—Radio-active barium chloride and carbonate have also been prepared, and both of these compounds resemble the sulphate in possessing the radio-activity which is supposed to be characteristic of the so-called new element radium. The presumption, therefore, is against the elemental nature of radium, although much remains to be done before the presumption can be called proof, and the Budapest professor proposes to carry on his researches until he has completely established his case.

Books Recommended.

1. **Elementary.**—Cartwright's *Practical Elementary Chemistry*. (London: Thomas Nelson and Sons.)

2. **Elementary Alternative.**—Pilley's *Chemistry of Common Things*. (London: Gill and Sons.)

3. **Advanced Theory.**—Newth's *Inorganic Chemistry* (London: Longmans); or Roscoe's *Advanced Chemistry* (London: Macmillan and Co.); or Baily's *Advanced Chemistry* (London: University Correspondence Press).

4. **Advanced Practical.**—Clowe's and Coleman's *Elementary Practical Chemistry* (London: Churchill), and *Elementary Quantitative Analysis*, by the same authors; or Newth's *Practical Chemistry—Quantitative and Qualitative* (London: Longmans).

5. **Honours Theory (Part I.).**—Newth's *Inorganic Chemistry*, as above; Tilden's *Chemical Philosophy* (London: Longmans); Tilden's *History of Chemistry during the Last Fifty Years* (London: Messrs. Cassell and Co.); Perkin and Kipping's *Organic Chemistry, Part I.* (London: Messrs. Chambers).

6. **Honours Practical (Part I.).**—Either Clowe's and Coleman's two books, or Newth's *Quantitative and Qualitative Analysis*, as above.

7. **Honours (Part II.) Theory.**—No book or books can be named as covering this course, but the student should thoroughly know as a foundation Newth's *Inorganic Chemistry* and the two parts of Perkin and Kipping's *Organic Chemistry*. He must also be well acquainted with the history of chemistry, for which Meyer's *History*, published by Macmillan and Co., will be very useful. For the rest, a thorough acquaintance with modern developments of chemical knowledge (to be got by a steady perusal of chemical literature—English, German, and French) is imperative; and the student is told that a very high standard of excellence will be requisite before he can hope to pass.

8. **Honours (Part II.) Practical.**—Clowe's *Quantitative Analysis* (London: Churchill), and Gattermann's *Organic Chemical Preparations* (London: Macmillan and Co.).

NOTES ON ADVANCED AND HONOURS PHYSIOGRAPHY.

Heliographic Determinations.—From the report of the Royal Observatory, Greenwich, we gather that in the year ending May 10, 1900, photographs of the sun were taken on 180 days, of which 369 have been selected for preservation. Photographs to supplement the Greenwich series have been received from India or Mauritius up to March 8, 1900. For the year 1899, Greenwich photographs have been selected for measurement on 202 days, and photographs from India and Mauritius on 162 days to fill up the gap, making a total of 364 days out of 365 for which photographs are available.

The chief characteristics of the sun's surface during the period covered by the report has been the steady decline in the mean daily number and area of spots observed, August and September 1899, in particular, showing a marked sub-minimum.

Magnetic Observations.—The variations of magnetic declination, horizontal force, and vertical force, and of earth currents, have been registered photographically, and accompanying eye observations of absolute declination, horizontal force, and dip have been made as in former years.

The principal results for the magnetic elements for 1899 are as follows:—

Mean declination.....	16° 34′·2 west.
Mean horizontal force.....	3·9947 (British units).
	1·8419 (Metric units).
Mean dip (with 3″ needles)	67° 10′ 13″.

The magnetic disturbances in 1899 were few in number. There were no days of great magnetic disturbance, and only 16 of lesser disturbance. Tracings of the photographic curves for these days, selected in concert with M. Mascart, are published in the annual volume.

Meteorology.—The mean temperature for the year 1899 was 50°·7, being 1°·2 above the average for the fifty years 1841–90.

During the twelve months ending April 30, 1900, the highest temperature in the shade was 90° (on August 15). The highest temperature recorded in the Stevenson screen in the Observatory grounds was 88·8, on the same day.

The month of August was exceptionally warm, the mean temperature for the month being 65°·5, which is 3°·9 above the average for the fifty years 1841–90. This high temperature for the month has only been reached before on one occasion in the previous fifty-eight years—namely, in August 1857. The month of November was also exceptionally warm, the mean temperature for the month being 4°·8 above the average.

The lowest temperature of the air recorded in the year was 18°, on February 9. There were fifty days in the year during

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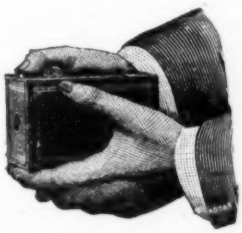

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which the temperature fell below 32°—a number slightly below the average.

Wind.—The mean daily horizontal movement of the air in the year ending April 30, 1900, was 268 miles, which is 13 miles below the average for the preceding thirty-two years. The greatest recorded daily movement was 776 miles, on April 13; and the least, 50 miles, on October 22. The greatest recorded pressure of the wind was 27 pounds on the square foot, on November 3; and the greatest hourly velocity, 48 miles, on April 13.

Sunshine.—The number of hours of bright sunshine during the same period was 1,630 out of the 4,454 hours during which the sun was above the horizon, so that the mean proportion of sunshine for the year was 0·367, constant sunshine being represented by 1.

Rainfall.—The rainfall for the period in question was 21·97 inches, or 2·57 inches less than the average of fifty years. The number of rainy days was 146. The rainfall in the month of August was only 0·354 inch—the smallest August rainfall for the fifty-nine years 1841–1900, the nearest approach to this being in August 1849, when the monthly rainfall was 0·45 inch. The rainfall of February was 3·58 inches, this being the wettest February for the preceding sixty years, with the exception of the years 1866 and 1879, when 4·03 and 3·81 were the respective falls registered.

The Age of the Earth: Novel Method of Determination.—Professor Joly, to whom the world of science is indebted for much ingenious astronomical suggestion, has lately brought before the notice of the Royal Dublin Society a method of estimating the age of the earth which follows neither the geological, the biological, nor the mathematical methods. The article is fully discussed in *Nature* for July 5, to which discussion we refer our readers for a full account of the communication, which we proceed to briefly outline.

It is first of all assumed that the denudation by solution of the land surface, since the first formation of a solid earth crust, has been on the whole a uniform process; and, further, that the amount of sodium now contained in the ocean has been for the most part transported to it by rivers since the land surface first became exposed to the action of solvent denudation. The reasons which, in the author's view, render these assumptions probable truths are fully discussed in the paper. If now we can obtain a correct estimate of the amount of sodium at present contained in the waters of the ocean, and also of the amount annually supplied to the latter by rivers, we have the requisite data whereby the earth's geological age may be determined. Basing his calculations upon the most careful and recent estimates, Professor Joly finds that the mass of sodium contained in the ocean amounts to $15{,}627 \times 10^{12}$ tons. In estimating the amount of sodium carried annually by rivers into the sea, Sir John Murray's analyses of nineteen rivers (including many principal ones) are quoted, and a result of 24,106 tons of sodium per cubic mile of river water is obtained. Sir John Murray's estimate of the annual river discharge into the ocean, amounting to 6·524 cubic miles, is also accepted. From these figures the mass of sodium annually carried to the sea is calculated, and this amount, divided into the total amount of sodium contained in the ocean, gives a result of 94,800,000 years as representing the duration of geological denudation. This is the outline of the scheme, which is divided into nine sections, the remaining eight of which discuss the various objections that may be opposed to those views.

In the first place it is universally admitted that the original hydrosphere was saline, and Professor Joly proceeds to assess the amount of this initial quantity of sodium, and corrects his estimate so as to make the age of the earth 86,900,000 years. By a further slight modification of the figures representing the sodium annually transported into the sea, a final estimate of 89,300,000 years is arrived at, a figure based, we are told, "on the most complete estimate of probabilities." But even in this estimate Professor Joly does not claim a degree of accuracy "approximating to so small a time interval as 100,000 years." The paper is one which no Honours student should omit to carefully read; we therefore strongly refer to the issue of *Nature* already named, and to Professor Joly's communication to the Royal Dublin Society.

Saturn.—Mr. W. F. Denning of Bristol, the great authority on meteorites and the consistent encourager of humble observers, has an article in the same number of *Nature* which we cordially bring under the notice of our readers, as its aim is to get the owners of small telescopes to do what they can in the matter of observation of Saturn, which, although low down towards the horizon, is yet well situated for observation, since the planet is placed at such an angle as permits the ring system to be seen with splendid effect. We now view the northern side of the ball and rings, and shall continue so to do until 1907.

On September 3 the planet will be occulted by the moon, when it will disappear at 7.16 and reappear at 8.11 p.m. These occultations of Saturn are somewhat rare, as may be seen from the fact that prior to June 13, when the moon also hid the planet from view, such a phenomenon had not occurred since October 1, 1888. The things to observe are—(1) the number and arrangement of the various belts; (2) the dark polar cap; (3) dark or light spots on the dusky belts or intervening zones.

Books Recommended.

Physiography and South Kensington.—The courses recognised by the Board of Education are four—namely, (1) Section One; (2) Elementary; (3) Advanced; (4) Honours.

Section One is really a practical course of elementary physics, and as a grant for practical work in this subject is now given by the Board of Education, teachers are strongly recommended to make the course a laboratory one.

Book—"*Section One*" *Physiography*, by Thomas Cartwright. (London: Thomas Nelson and Sons.)

Elementary.—Book—*Elementary Physiography*, by R. A. Gregory. (London: Thomas Nelson and Sons.)

Advanced.—Book—*Advanced Physiography*, by R. A. Gregory. (London: Thomas Nelson and Sons.)

Honours.—The only book specially written for this course is *Honours Physiography*, by R. A. Gregory. (London: Thomas Nelson and Sons.) This book does not profess to do more than deal suggestively with some of the more important questions coming under the purview of the Syllabus; but every Honours student should master the whole of the book, and, in addition, must acquaint himself thoroughly with one branch of the subject by keeping abreast with modern research. By closely following these notes, such suggestions and references will be given as will enable the earnest student to know what is required and where to look for it. *Knowledge*, *Nature*, *The Geological Magazine*, *The Observatory* are a few of the periodical publications to which the student may usefully refer in his attempt to keep abreast with the times, as required by the Syllabus.

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Assistant, Mathematical and Mechanical Division, Royal College of Science, London.

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As inquiries are constantly being made about suitable text-books for these stages, as well as for the Elementary and Honours stages, we give below the names of the authors and publishers of several works.

Stage 1.—The following books are arranged for this stage, and contain sections on arithmetic, algebra, and geometry:—

Hall and Stevens, *An Elementary Course of Mathematics* (Macmillan and Co.) The arithmetic section consists of examples only.

Longmans' *Elementary Mathematics* (Longmans, Green, and Co.)

Hatton and Bool, *Elementary Mathematics* (Whittaker's).

If the student intends to work beyond Stage 1, instead of one of the above he had better obtain either Hall and Knight's *Elementary Algebra for Schools* (Macmillan and Co.), or C. Smith's *Elementary Algebra* (Macmillan and Co.), as well as a text-book of Euclid containing Book I. (for Stage 1), such as Hall and Stevens, Smith and Bryant, Todhunter and Loney, all published by Macmillan and Co., or any other of the numerous text-books—for example, Nixon's (Clarendon Press).

Stage 2.—*Algebra.*—One of the following: Hall and Knight's, with answers (Macmillan and Co.); C. Smith's (Macmillan and Co.); Todhunter and Loney's (Macmillan and Co.).

Trigonometry.—Hall and Knight's (Macmillan and Co.); Lock's (Macmillan and Co.); Loney's, Part I. (Cambridge University Press); Hamblin Smith's (Longmans).

Geometry.—Books II., III., and IV., by any of the authors mentioned in Stage 1 above.

Mathematical Tables.—Bottomley's or any other Four-figured Tables, or Chambers's Tables.

Stage 3.—*Algebra.*—Hall and Knight's *Higher Algebra* (Macmillan and Co.); Todhunter and Loney's (Macmillan and Co.); C. Smith's *Treatise on Algebra* (Macmillan and Co.); *Intermediate Algebra*, Briggs and Bryan (U.C.C. Press).

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We may also use this opportunity to again urge upon our readers, especially those who are interested in the various examinations, the importance of numerical exercise work. It is not enough to read through and agree to the various propositions, theorems, etc., into which the subject is divided; it is much better to proceed more slowly, working out carefully numerical exercises wherever possible. These continually present new phases and features of the subject, will tend to clarify the notions and ideas, and it will be found that the time so spent is well repaid by the clearness of view that will be obtained. Such numerical exercise work presents little trouble when logarithms are used. For this purpose four-figure logarithms (such as are now used by, and presented to, students in several science subjects under the Board of Education) are very convenient; by such means the troublesome operations of multiplication, division, involution, and evolution are readily performed. Even the student not accustomed to the use of such valuable aids to calculation will find about an hour devoted to their use and manipulation frequently all that is necessary.

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MUNICH INTERNATIONAL ART EXHIBITION, 1901.

The eighth of a series of International Art Exhibitions will be held at Munich in 1901, and will be promoted by the Munich Artists' Club and the Plastic Art Union of Munich.

It will be conducted, for the most part, on the same principles as the last exhibition (the seventh), which was held in 1897. Special efforts will be made to secure success, in view of the eightieth birthday of the Prince Regent of Bavaria. The co-operation of British artists is cordially invited.

The exhibition of 1897 comprised painting, sculpture, etching and engraving, and design, both as illustrated by drawings and as carried out in materials.

Further information can be obtained upon application to the Secretary of the Artists' Club, Künstler Genossenschaft, Munich.

SCIENCE NOTES.

Artificial and Natural Silks.—There are several tests for distinguishing natural and artificial silks. One is the size of the threads as shown by the micrometer, the smallest natural silks having a diameter of 9 to 15, never exceeding 20 micromillimetres, whereas that of the smallest artificial silk is 40 to 50 micromillimetres, the largest being as much as 132 micromillimetres. All artificial silks, except that made from gelatin, are bifringent. They do not give the peculiar unpleasant smell on burning that is given out by natural silk. When they are heated to a temperature of 200° C. in sulphuric acid, they become charred and fall to powder, while natural silk is not sensibly attacked. Silks that are made from nitro-cellulose are not always completely denitrated, as may be shown by the reaction with a solution of diphenylamine in concentrated sulphuric acid. Herzog quantitatively separates nitro-cellulose silk from natural silk by means of an alkaline solution of copper and glycerin. True silk is dissolved in this menstruum, but not the artificial fibres. A saturated solution of zinc chloride dissolves natural silk at 100° to 110° C., but not nitro-cellulose silk until the temperature reaches 120°; while the wild "tussah" silk requires a still higher temperature, approaching 140° C., for its solution. Aqueous iodine solution stains artificial silks brown, natural silks yellow. The latter is coloured brown by the action of sulphuric acid and iodine, while cellulose silks are coloured blue by the same reagent.

Bacteria and the Temperature of the Liquid Air.—Some interesting experiments have been made by Macfadyen on the influence of the temperature of liquid air on bacteria. He subjected cultures of various bacteria to the temperature of liquid air (– 183° to – 192° C.) for twenty hours. Gelatin, potato, and broth were the media selected for testing these organisms. The bacteria used in the experiments were *B. typhosus*, *B. coli communis*, *B. diphtheriæ*, *Spirillum choleræ Asiaticæ*, *B. proteus vulgaris*, *B. acidi lactici*, *B. anthracis*, *Staphylococcus pyogenes aureus*, *B. phosphorescens*, and *Photobacterium balticum*. After being taken out of the liquid air, the cultures were carefully thawed and examined. In no instance could any impairment of the vitality of the micro-organisms be detected. The fresh growths obtained by sub-culturing were normal, and the functional activities of the bacteria were equally unaffected. The colon bacillus curdled milk, fermented sugar, and formed indol; the *Staphylococcus aureus* retained its pigment-producing properties, anthrax its pathogenic action upon animals, and the phosphorescent organisms their luminosity: with regard to the latter, the cultures when cooled down became non-luminous, but on thawing, the luminosity returned with unimpaired vigour. Plate cultivations made with liquid air itself gave colonies of the ordinary forms met with in air. In a course of further experiments with Rowland the foregoing results were confirmed, but the test was more severe. Cultures of the before-mentioned organisms, and also a sarcina, a yeast, and unsterilised milk, were placed in a broth emulsion, in fine quill tubing hermetically sealed. These were immersed in the liquid air supplied by Professor Dewar, and a temperature of about – 190° C. maintained uninterruptedly for seven days. No structural alteration could be detected in the organisms, and their vitality and biological characters remained unimpaired and unaltered. At some future date Macfadyen hopes to undertake experiments with liquid hydrogen.

A New Substitute for Kola.—What is likely to be useful as a substitute for kola and cocoa has been discovered by Hendrickx and Coremans. They gave the dried leaves of the plant to various herbivorous domestic animals in the form of an electuary, in the dose of one gramme to each 70 kilos of body weight, and found it had a powerful stimulating effect on the processes of nutrition. It has a distinct diuretic action, but it has no influence either on the heart, the respiration, or the temperature, and it does not possess any antiseptic properties.

Hybrids and Parental Properties.—In a recent number of the *Comptes Rendus*, Hugo de Vries maintains that a hybrid never "halves" any of the special characters either of the father or of the mother. It inherits some characters from the one parent, some from the other. When the parents differ only in one point, the hybrid resembles one parent or the other, and does not occupy an intermediate position between the two. In the hybrid the simple differential character of one of the parents is evident or "dominant," the antagonistic character of the other parent being latent or "regressive." During the whole of the vegetative life of the hybrid these antagonistic characters usually remain combined—the one dominant, the other latent. In the reproductive period they become separated, each pollen grain and each oosphere receiving only one of the two.

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Circular 448.
A.

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THE EDITOR'S TABLE

AMERICAN BOOK COMPANY.

Mind and Hand: Manual Training the Chief Factor in Education. By Charles H. Ham. Being the third edition of *Manual Training, the Solution of Social and Industrial Problems*. This is an American book in the worst sense of the term. The chapters on the "Ideal School," which might have been a valuable description of a manual training school for advanced pupils, are hopelessly spoiled by "highfaluting" (we must borrow the transatlantic epithet which alone describes the style). In his historical retrospect, the writer shows not the least appreciation of the Greek and other ideals of education. His insight into modern conditions may be gathered from the following sentences:—"But notwithstanding the fact that social tendencies in America seem to be similar to those of Europe, it is upon America alone that the eyes of mankind rest with an expression of ardent hopefulness. Nor is this hope destitute of a basis of rationality. It is in the United States, for the first time in all the ages, that a good reason can be given for indulging the sentiment of patriotism." His claims on behalf of manual instruction are stated with a precisely similar sense of proportion and perspective. This proves all the more disappointing to a reader who thoroughly believes in the value of such training. "Save me from my friends," is likely to be the most pious wish of such a reader. The most useful part of the book is the appendix, giving statistics of the "physical progress" of manual training in Europe and America up to 1898.

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A First Geometry Book. By J. G. Hamilton, B.A., and F. Kettle, B.A. Pp. ii, 91. As the readers of our review columns will have noted, a notable reaction is setting in against Euclidian methods, at all events in the earliest stages of geometrical teaching. Instead of being set to learn a host of unlovely and (to him) largely unmeaning definitions, our pupil is now made to cut triangles out of paper, to master their properties by the senses, and, in part, to replace an effort at reasoning by measurement and observation. On the whole, we believe that this movement is in the right direction; and of the many books now before the public whose object it is to put these precepts into practice, this is one of the best we have seen. Its sub-title describes it as "A Simple Course of Exercises based on Experiment and Discovery," and the authors claim—fairly, we think—that their "exercises are carefully planned to this end, and only sufficient guidance given to prevent waste of effort." The book is not a text-book of geometry, but rather a laboratory book for practical work, a collection of exercises for the pupil to master, answers and hints to which are published separately for the use of teachers.

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Geometrical Drawing, Part II. By W. H. Blythe, M.A. Pp. xi, 136. This little book—a member of the Cambridge series for schools and training colleges—is the second part of a work which has been already noticed in our columns. It provides a course of instruction, complete in itself, in solid geometry suited to the elementary stage of science subjects (p. 78 of *Science and Art Directory*, 1899), and is also intended to meet the needs of all army candidates. We have great pleasure in recommending it. It is well got up, and, considering the number of figures provided, is cheap. Some sixty examples from the Science and Art examinations, with explanatory notes where necessary, are added at the end.

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Alfred, The Model of English Kings. By Philip Gibbs. This little book should be popular amongst young readers, with whom Alfred is always a favourite character. The celebration of his millenary next year will undoubtedly cause increased interest in the story of his life, which is here presented in simple and concise form. We are surprised, however, at the inclusion of the pretty but fabulous incident of Alfred's mother teaching him to read. When Alfred was "twelve years" old, his own mother, Osberga, had long since been dead or divorced, and his stepmother, Judith, had left England. In any case, it is hardly likely that a French princess would be able to teach Anglo-Saxon.

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Greater Britain: Its Rise and Growth. This book supplies a distinctly felt want. While there have been large numbers of historical readers of the usual character, a history of the empire suitable for the upper classes of elementary schools and for evening continuation schools has not before appeared. We have read this book through from cover to cover with great interest. It is remarkably well written in vigorous English, and the writer has evidently a good knowledge of the capacity of the boys and girls for whom it is mainly written.

The matter is, on the whole, well divided and distributed, the only fault we have to find in this respect being, that India has about double the space allotted to it that is given to Australia and Africa. Doubtless India has had a stirring history, and our struggles there were long and keen, but the other two, in their way, furnish equally striking matter. A short paragraph might have been inserted on p. 172 referring to the present South African campaign, which would have brought the work completely up to date. An awkward expression on p. 85, par. 5, "the largest ever we had raised," may be improved in the next edition, as well as the printer's error on p. 88, par. 4, "When she was proceeding to this self-sacrifices." The summaries at the end are excellent, and the leading dates will be serviceable for reference and for memory work. The spellings at the end might have been omitted.

The book is well printed, bound, and illustrated.

The Reign of Queen Victoria. We are able to speak of this book in terms of the highest praise. It deserves a place not only on the shelves of the day school as a reader, but on the shelves of our public libraries; for we feel sure that many of our town and village politicians, perfectly familiar with the matter set forth, would read it from sheer delight in the style. Each chapter is a cameo in a beautiful setting. The writer is to be congratulated on his complete success in putting a highly readable and interesting book into the hands of the boys and girls of this generation. If they "read, mark, learn, and inwardly digest" what is so ably put before them, they will obtain a wonderful insight into the great movements of the Victorian era, and will be brought to admire many, and venerate some, of the men who took part in those movements.

If we have any fault to find with the book at all, it is that the writer has scarcely given sufficient prominence to the remarkable inventions of the Victorian era. We know that a writer is limited by space, but the lists of meanings of words might have been omitted, as they are now almost universally condemned, and the spellings at the end of the book also. This would have allowed two or three chapters for inventions.

The illustrations are suitable and good. It is needless to say that the work is well got up.

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The Greek Drama. By Lionel D. Barnett, M.A. This is a useful and thorough little primer which does not claim for itself originality, but forms a good introduction to larger works on the Greek drama. It treats of the elements of the drama, satyr play and tragedy, the Greek tragedians, the old comedy and its origins, Aristophanes and his contemporaries, the Attic theatre of the fifth century, the later Greek drama, and the later theatre of Athens. There is an appendix on the Roman drama and the parataxis. The illustrations are taken mainly from vase paintings. For further reading the student is referred to Dorpfield's *Das Griechische Theater*, Huddelston's *Greek Tragedy in the Light of Vase Paintings*, Haigh's *Attic Theatre*, and Verrall's *Euripides the Rationalist*. There is a good bibliographical note on the literature of the Greek drama as far as 1895. The book is prettily bound.

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$t{\cdot}45$
$7{\cdot}86$
$60{\cdot}6\varepsilon$
$6{\cdot}te4$
$\cdot 5226$
$67{\cdot}\varepsilon 066$

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far from being the case is put before us by her in a very pleasant manner. The chapters on Colour and Form in regard to Clothing, Drafting Shapes, Drafting on Geometrical Principles, Draping Crowns and Toques, Notes on Trimmings, How to make a Bridal Veil, Stitches used in Millinery, Approximate Cost of some Millinery Materials, Glossary of Terms employed in Millinery, and Identification of Materials, are, it appears, introduced for the first time into any manual dealing with this subject. These are most valuable and welcome additions; but it would have added considerably to the clearness of the arrangement if that portion treating of the stitches used, terms employed in millinery, etc., came at the beginning instead of the end of the volume. Praise must be given to the diagrams, which are excellent; but the method of lettering the different items in the diagrams in connection with the letterpress is, in some cases, somewhat obscure. The chapter on Renovations will be specially useful in many households; and we can safely recommend Miss Clara Hill's book to the notice of those who wish to trim or "do up" their own hats, as well as to those who desire to study the subject from an educational point of view. The price of the volume is two shillings, which is not excessive, considering the amount of information contained in it.

THOMAS MURBY.

Analysis of English History. By W. C. Pearce and Dr. S. Hague, LL.B. Revised by W. F. Baugust. This old friend now appears in the ninety-fifth edition, with the earlier period entirely rewritten, and the latter part brought up to date. The book is so well known that it is only necessary to call the attention of our readers to this new "birthday."

Elements of Mineralogy. By Frank Rutley, F.G.S. A book that has reached a twelfth edition calls for little remark, so that all we need say about Rutley's *Mineralogy* is that it has deservedly attained to the honour of a twelfth edition.

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An Elementary Course in Practical Physics. By F. Castle, M.I.M.E. This handbook is intended for first and second year students in science schools and classes. It has sections dealing with mensuration, mechanics, sound, light, heat, magnetism, and electricity. The experiments, which are numerous, are so arranged that they may be taken in any desired order. At the end of each chapter there is a short recapitulatory summary and numerical exercises on the subject-matter, which have been selected chiefly from the examination papers of the Science and Art Department. Instruction is given for laboratory work. The book is clearly printed and strongly bound, and the subject-matter is well arranged. It should be useful to students preparing for examinations.

Timber and Tools: A Text-Book for Manual Training Classes. By Jerome Wallace. This work, consisting of 218 pp., is intended as a companion volume to *Woodwork for Schools*, by the same author. The matter is about equally divided between "Timber" and "Tools."

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WILLIAM PULMAN.

How to Learn a Foreign Language. Intense as is our interest in the methods of successfully teaching a foreign tongue, we took up Mr. Pulman's book in the hope of having a treat. We were disappointed, as there is very little of novelty and less of suggestion in sixty odd pages devoted by the author to his subject.

G. P. PUTNAM'S SONS.

Heroes of the Nations: Oliver Cromwell. By Charles Firth, M.A. This is the twenty-eighth volume of this popular and well-timed series. The author is to be congratulated upon the production of a scholarly and at the same time interesting history of one of Britain's greatest sons. Mr. Firth, by this work alone, would take a high position in the ranks of those who depict the past. In every chapter there is abundant evidence of careful research and clever sifting of material, and consequently we get a masterly, complete, and graphic biography of the soldier-statesman. The part played by environment is well brought out in the opening chapter. The author takes pains to introduce us to Cromwell in private as well as in public. We know of no other book of this size, except Carlyle's, which helps us to know the Protector's real character so well. It must not be forgotten that this is, too, a history of the rule of the Puritans in England. We are able to clearly follow the wonderful currents and cross-currents of those eventful years. All the great actors of that time have their strong points and eccentricities placed before us. Cromwell was from the first the champion of his religious views. His first speech in the Commons, it seems, was on some question of religion, and he condemns a minister for preaching "flat Popery" at St. Paul's Cross. Mr. Firth shows us that a kind of religious fanaticism was Cromwell's ruling passion all through. In the account of Marston Moor, Cromwell says, speaking of the Royalists, "God made them as stubble to our swords." And again, of Naseby, he writes, "I had great assurance, and God did it." He was a firm believer in the dispensation rather than in the revelation of Providence. Upon this aspect of the subject Mr. Firth aptly writes: "Religious rather than political principles guided his action, and his political ideals were the direct outcome of his creed. Not that purely political considerations exercised no influence on his policy, but that their influence, instead of being paramount, was, in his case, of only secondary importance."

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been learning French for four or five years, and if asked the French for 'ceiling,' he stared; for 'floor,' and he perused the matting. He could neither wink, nor yawn, nor cough, nor sneeze, nor blow his nose in French, though he might very possibly have been able to describe in French all the parts of a man-of-war, or of a porcelain fiddle." A boy or girl who studies this book in the way suggested by Mr. Storr will soon be able to do all these things, and more, in French.

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German Prepositions at a Glance. By C. Kaiser and A. Thouaille. This little book is an attempt to teach German prepositions, and the case relationships they express, by means of picture. The idea is a good one, and is successfully worked out by the authors.

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Is the Money Well Spent? Yes. By Rev. Gregory Smith, M.A., Hon. LL.D. This little *brochure*, as its title implies, is a declaration that, however faulty our system of education may be, the money spent upon it is well spent. The pamphlet is in the form of a letter to Sir John Gorst, whom it compliments upon the encouragement given to educationists by the 1900 Code, and desiderates "multum" whilst decrying "multa." Whilst appreciating the earnestness and thoughtfulness displayed by Mr. Smith in his letter, we must dissent from his view that "whether a better preparation for specialising will ever be found in schools of this kind [higher grade—that is, secondary] than Latin or Greek may be doubtful." Many are of Spencer's opinion, that there is nothing in the way of training that can be got from Latin and Greek that cannot be got from a study of science, whilst there is much to be got from the latter that cannot be obtained from the former; but *de gustibus non est disputandum*.

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Curiosities of Light and Sight. By Shelford Bidwell, M.A., LL.B., F.R.S. This interesting little book records and expounds some of the many optical illusions to which the human eye is subject. Starting with a discussion of the nature of ether, which is stated to be something totally dissimilar from the rigid elastic solid so often spoken of in text-books, the eye is next described, and, finally, a discussion of the why and wherefore of the illusions in question is gone into. Concerning the eye, the author, after referring to the many defects thereof, goes on to add, not to this evidence against design, but that, "with all its anomalies, the eye fulfils its proper function very perfectly, and is regarded by those who have studied it most closely with feelings of wonder and humble admiration." We have read the book with much pleasure, and recommend it cordially to the notice of all who are interested in the study of light, or in that part of it which is concerned with optical illusions.

Functions of Squares: The Universal Solution for Numerical and Literal Equations, by which the Roots of Equations of all Degrees can be expressed in Terms of their Coefficients. By M. A. M'Ginnis. Pp. x, 195. We confess that on our first survey of this book we thought that Mr. M'Ginnis was attempting to perpetrate a huge joke upon the scientific world. For this hasty impression we humbly crave pardon, since a further study of "this volume of the author's mathematical discoveries" has convinced us that he is in deadly earnest; and as we gazed and gazed, "still the wonder grew that one small head could carry all" that Mr. M'Ginnis knows in the way of supreme illogicality and perverse ingenuity.

Many of our readers may not be aware of the history of the problem which our author here professes to solve most completely. For their benefit let us say that while the roots of the quadratic equation $ax^2 + bx + c = 0$ can, of course, be expressed in terms of the coefficients a, b, and c, and while Cardan has showed that the roots of the cubic equation $ax^3 + bx^2 + cx + d = 0$ can also be expressed in terms of a, b, c, d, and Ferrari, Simpson, and Descartes have worked out a process for the quartic equation $ax^4 + bx^3 + cx^2 + dx + e = 0$, no one has yet succeeded in doing this for the quintic or higher equations. Further, the Norwegian mathematician N. H. Abel, in 1824, gave a rigid proof that it is *impossible* to express the roots of $ax^5 + bx^4 + cx^3 + dx^2 + ex + f = 0$ in finite algebraical terms of a, b, c, d, e, f; and all subsequent mathematicians have agreed that Abel's demonstration is absolutely unassailable. Against this formidable array of "all subsequent mathematicians" comes Mr. M'Ginnis of Neosho, Missouri, with Mr. W. M. H. Woodward of the "United States Interior Department, Santa Fe, N.M.," as his trusty henchman, to try a throw. We regret that, in view of the phalanx of talent opposed to him, Mr. M'Ginnis has not assumed more trusty and less rusty armour. It is hard to meet an attack upon the collective genius of seventy years seriously when we find the attack prefaced by a series of almost utterly irrelevant and quite utterly unnecessary geometrical definitions such as these, which we find on page 5:—

"A *problem* is a proposed proposition of something to be done.

"A *right angle* is the opening between two lines that meet in a common point forming a square corner.

"An *isosceles triangle* is a triangle having two equal sides, and equal angles opposite the equal sides.

"A *square* is a figure bounded by four equal sides, and having four square corners."

These are but samples out of a rich budget of paradoxes, to the polychrome absurdity of which only De Morgan could adequately do justice. Nor is even our author's English beyond reproach. Surely such language as, "As all equations of the third degree, having all its terms expressed, cannot be solved by quadratics without removing second term," is not commonly current in Neosho, Missouri. Perhaps these are trifles. We appeal, then, to the last three pages of the book in proof of the statement which we unhesitatingly make that Mr. M'Ginnis's mathematical equipment is quite inadequate to the task he sets himself. He there examines the Ferrari-Waring-Simpson solution of the biquadratic equation. He first pats it approvingly on the back, saying that it "is the most pleasing and polished artifice ever offered for a general solution of the fourth degree." Having thus put Messrs. Ferrari, Waring, and Simpson off their guard, he gets his little stroke in, and declares that "it requires but little probing to expose its compassed application." We have but a shadowy idea as to what a "compassed application" may be, but we read on to discover; and after a wonderful demonstration of the "compassed application" of our author's logical powers, we reach the conclusion, simply untrue to fact, that the method is applicable only when the sum of two roots of the biquadratic is the same as the sum of the other two.

If THE PRACTICAL TEACHER were a technical scientific journal, it might be necessary, and would be interesting, to criticise the book at greater length. The elaborate contribution wherein Mr. W. M. H. Woodward attempts to show the flaw in the "Wantzel Theorem," a later form of Abel's demonstration, and shows only that he does not understand the theorem he assails, provides much food for reflection, and still more for amusement. But we conclude by a more practical challenge. The author says he has solved the quintic equation. Very well, then: let him publish in this journal a value of x in finite algebraical terms of a and b which satisfies the equation $x^5 + ax + b = 0$, and the present reviewer will not only humbly apologise for this his review, but will pay £10 to any charity the editor shall name, or, if the author prefers it, will spend £10 in copies of this book for free distribution at Cambridge.

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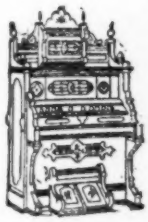

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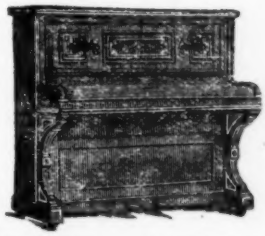

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